3rd International Conference on Future Technologies in Manufacturing, Automation, Design & Energy

DECEMBER 14-16, 2022

SOUVENIR & BOOK OF ABSTRACTS

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NATIONAL INSTITUTE OF TECHNOLOGY PUDUCHERRY, KARAIKAL, INDIA

(AN INSTITUTE OF NATIONAL IMPORTANCE UNDER MINISTRY OF EDUCATION, GOVT. OF INDIA)

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MESSAGE FROM THE DIRECTOR

I take immense pleasure and privilege in welcoming the participants for the 3rd International Conference on Future Technologies in Manufacturing, Automation, Design and Energy (ICoFT MADE 2022) organized by the Department of Mechanical Engineering, National Institute of Technology Puducherry conducted from 14th to 16th December 2022. In this resurgent and competitive world, India's economy is growing at a faster pace because we are developing consistently and qualitatively in various fields such as technology, manufacturing, agriculture, education, space research, defence, renewable energy etc., ultimately helping create something new and pioneering to the society. This development is truly viable only because of the passionate and innovative research focus by nationwide researchers and academicians. At this juncture, let us remember and follow the views of our honourable Prime Minister Mr. Narendra Modi such as 'Swatchh Bharat', 'Make in India', 'Digital India', 'Cashless Economy', 'NEP 2020' etc., that were launched for the upliftment of the society.

The response shown by the like-minded academic fraternity towards this conference is outstanding. Presenting quality research papers at such conferences is very valuable for research scholars. I strongly believe that this International Conference will serve as a platform for the researchers to share their research findings with others, gain valued knowledge from other's research and expand their contacts for future research collaborations. I strongly believe that this International Conference will serve as a forum for scholarly discussions on future technologies in manufacturing, automation, design and energy. I sincerely offer my earnest gratitude to those who have contributed through their research papers at the conference.

The unified efforts of a dedicated and committed team is necessary for organizing such conferences. We are blessed enough to have such a hardworking dynamic team with us. I wish for the grand success of the conference.

Prof. K. Sankaranarayanasamy
Director, NIT Puducherry

MESSAGE FROM THE CHAIRMAN

It is my great pleasure and privilege to welcome all to the THIRD International Conference on Future Technologies 2022. This conference comprises the theme of Manufacturing, Automation, Design & Energy, in short, ICoFT MADE 2022. 98 papers have been selected for the presentation based on the theme MADE from the participants of foreign universities, CFTIs, state universities and renowned private universities of India as well as scientists, industry personnel, and entrepreneurs across the globe.

The ICOFT team is also in immense happiness to host this international conference in the hybrid mode, being the first to organize a hybrid mode international conference from NIT Puducherry after pioneering the last two years through online mode. Such a hybrid conference will undoubtedly encourage young researchers to interact with fellow researchers and experts to extend their research network. Eminent professors from India, USA, and UK are delivering the invited talks and share their research, knowledge, and experience with the conference participants.

The Department of Mechanical Engineering renews itself by expanding its territory annually through ICOFT. This time, the conference has been recognized by the Science and Engineering Research Board (SERB) for partial funding and attracted other prominent industries such as Kan-Tht, Anton Paar, Ducom, and Edutech as sponsors.

ICOFT MADE 2022 also plans to recommend the research articles to one of the publishers, namely, Materials Today: Proceedings (Elsevier), Advances in Science and Technology (TransTech Publication), and IOP Conference Series: Materials Science and Engineering (IOP) based on the quality/nature of the research and merit of the presentation.

Using this opportunity, I extend my gratitude to the Patron, Eminent Plenary Speakers, Organizing Secretaries, Reviewers, Session Chairs, Committee Members, and Sponsors of ICOFT MADE 2022 for their involvement and support.

I wish the active participants of ICOFT MADE 2022 to have ever-lasting learning.

Dr. A. Johnney Mertens
Chairman, ICoFT MADE 2022, NIT Puducherry

ABOUT THE INSTITUTE

National Institute of Technology Puducherry (NIT Puducherry) is the 31st institute of NIT Fraternity established in 2009, as a part of the Nation's Eleventh Five-Year Plan (2007–2012). It is officially recognized as an Institute of National Importance under the Ministry of Education, Government of India. The Institute is nestled in the coastal enclave of the Kaveri River basin in Karaikal, Union Territory of Puducherry. The campus is spread across 258 acres plot of land located near the village of Poovam and around 7 km from the city's heart. Currently, 61 faculty members and 31 non-teaching staff are employed for the overall strength of 939 students.

NIT Puducherry is committed to produce competent and responsible technocrats who can serve the nation on its journey to growth and prosperity. The Institute provides keen guidance to sculpt bright minds into professionally balanced individuals through expert and experienced faculty members and facilities. The Institute is constantly attempting to scale new heights by developing a synergy between academics, research, and practice. NIT Puducherry is ranked 136 under the Engineering Institutes category in the NIRF India Ranking 2021 released by the Ministry of Education, Government of India.

ABOUT THE MECHANICAL ENGINEERING DEPT.

The Department was established in July 2014 with an Undergraduate Program and currently offers Postgraduate and Doctoral Program. New Education Policy (NEP) curriculum is implemented to ensure the core courses with the latest developments, social context, and environmental relevance of the present and future world. At present, 12 dedicated and competent faculty members with expertise in diverse domains of Mechanical Engineering such as Thermal and Fluid Sciences, Design, and Manufacturing. The specialization in the various fields of Mechanical Engineering such as Industry 4.0; Energy; Design Automation; New Materials and Manufacturing processes; Smart Manufacturing; Vehicle Dynamics; Liquid Spray characteristics; Computational Mechanics; Ergonomics; Welding; Vibrations contribute to the Department knowledge hub. The Department is actively conducting various sponsored projects from the agencies or schemes such as DST-SERB, DST-INSPIRE, DST-UKIERI, ARTPARK, BRICS, and providing consultancy services to organizations such as ONGC, CPWD, and CPCB. The Department is in the pursuit of establishing world-class academic and research facilities and emerge as a prominent source of practical engineering knowledge.

MECHANICAL ENGINEERING DEPARTMENT PROFILE

Prof. K. Sankaranarayanasamy
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Ergonomics at Workplace, Industrial Safety, Laser Material Processing, Power plant Structure analysis, Natural Fiber Composites

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Dr. S. Somasundaram
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Combustion, Acoustics, Supersonic flows, Numerical simulation

Dr. P. Sathish Kumar
ASSISTANT PROFESSOR

Vehicle Dynamics, Active suspension, Energy Harvesting, Tire Blow-out

Dr. A. Karpagaraj
ASSISTANT PROFESSOR

Welding, WAAM, Hard-facing, Welding Simulation, PMC

Dr. R. Naveen Raj
ASSISTANT PROFESSOR

Vibrations, Optimization techniques, AI/ML Techniques in Mechanical Engineering, Biomechanical Modelling

KEYNOTE LECTURE I

First steps towards Smart Remanufacturing – Progress in Robotic Disassembly Research

PROF. DUC TRUONG PHAM
DEPARTMENT OF MECHANICAL ENGINEERING,
THE UNIVERSITY OF BIRMINGHAM, UNITED KINGDOM

Remanufacturing is the process of returning a product that has reached the end of its service life to at least its original condition with a warranty equal to, or longer than, that for the original product. ANSI RIC001.1-2016 (Specifications for The Process of Remanufacturing) defines remanufacturing as "a comprehensive and rigorous industrial process by which a previously sold, leased, used, worn, or non-functional product or part is returned to 'like-new' or 'better-than-new' condition, from both a quality and performance perspective, through a controlled, reproducible, and sustainable process." Remanufacturing is integral to a circular economy, saving raw materials and other resources including energy and water and drastically cutting greenhouse gas emissions and the need for landfill. The first task in almost all remanufacturing operations is the disassembly of the 'core' or the product to be remanufactured. Due to the condition of the used product, disassembly can be a difficult task that has so far been almost exclusively undertaken by human operators. This presentation describes research into robotic disassembly by our Autonomous Remanufacturing Laboratory. The presentation will cover the five areas of work in the Laboratory: disassembly science, disassembly strategies, disassembly planning, collaborative disassembly and disassembly case studies. The presentation will conclude that dawn has broken on research into robotic disassembly, but much work will still be needed to enable the widespread industrial application of robots in disassembly and achieve smart remanufacturing.

KEYNOTE LECTURE II

Polymers and composites - Versatile tribo-materials

PROF. BIJWE JAYASHREE
DEPARTMENT OF MECHANICAL ENGINEERING,
INDIAN INSTITUTE OF TECHNOLOGY DELHI, INDIA

Based on requirements of magnitudes of friction and wear, tribo-applications and tribo- materials are divided into five categories viz, very low μ- very low wear; high μ- high wear; high μ- low wear; high μ- very low wear and very high μ- zero wear. Polymer composites are the only materials suitable for all the sectors. The talk describes the overview of these applications of polymer composites/ nano-composites with recent research activities and contributions in the field.

KEYNOTE LECTURE III

Academic Research in Reverse Supply Chains, Disassembly and Remanufacturing: A Comprehensive Overview

PROF. SURENDRA M. GUPTA
MECHANICAL AND INDUSTRIAL ENGINEERING
NORTHEASTERN UNIVERSITY, BOSTON, UNITED STATES

Individuals would like to preserve the current and future economic profitability, environmental protection and standard of living. This necessitates the need for sustainability which is the ability to continue the current behavior indefinitely. This requires a push for reduction and elimination of waste as well as conservation of resources which are the goals of lean manufacturing and product recovery via reverse supply chain. Reverse supply chain consists of a series of activities required to collect used products from consumers and reprocess them to either recover their leftover market values or dispose of them. Remanufacturing is an important element of reverse supply chains. The increase in the popularity and implementation of remanufacturing have created many challenges due to uncertainties in the quality and quantities of returned products, difficulties in estimating the remaining lives of the components, unknown timings of the availability of end-of-life (EOL) products, balancing the remanufacturing line, pricing decisions, warranty cost estimation and opportunity for committing fraud by third party and customers, to name a few. This presentation will offer an overview of the various modelling techniques used by researchers to address the challenges as well as avenues for future research.

KEYNOTE LECTURE IV

Understanding Flow Dynamics, Viability and Metastatic Potency of Cancer Cell Lines using Microfluidics

PROF. GAUTAM BISWAS
DEPARTMENT OF MECHANICAL ENGINEERING,
INDIAN INSTITUTE OF TECHNOLOGY KANPUR, INDIA.

In order to understand the challenges of metastasis, a microchannel of 35 µm diameter, constricted to 7 µm over a distance of 200 µm in a total length of 3 mm, was designed and fabricated using a mask aligner made of polydimethylsiloxane (PDMS) to mimic in vivo capillaries. A thin glass cover-slide was mounted on top to monitor the motion of single or aggregated malignant HeLa cells (size 17–30 µm) microscopically through the constricted microchannel at a constant flow rate of 30 µl/h. Quantitative deconvolution of high-speed videography of a single cell of 30 µm revealed cellular deformation while passing through constriction, having elongation index, average transit velocity and entry time of 2.67, 18 mm/s and 5.1 ms, respectively. Morphological analysis of live and apoptotic cells by dual staining with Acridine Orange/ Ethidium Bromide demonstrated retention of a significant viable cell population after exit through the constriction and a viability index of 50% was quantified by dye exclusion assay. The cumulative data for microfluidic parameters, morphology and relevant metastatic MMP2 gene expression efficiency measured by real-time polymerase chain reaction revealed retention of virulence potency that could possibly cause metastasis (Nath et al., 2018).

While the epithelial-to-mesencymal transition (EMT) is known to be an important factor in cancer spread, how the converted cells travel through the blood vessels and undergo reverse transition (mesenchymal-to-epithelial, MET) at the secondary sites has hitherto not been completely understood. The microfluidics-based interdisciplinary research initiatives (Nath et al., 2019), in which the speaker was a member, were successful to understand how the MDA-MB-468 cells lose their EMT phenotype and revert back to epithelial format through a process termed MET.

B. Nath, A. Raza, V. Sethi, A. Dalal, S. S. Ghosh and G. Biswas, ***Understanding flow dynamics, viability and metastatic potency of cervical cancer (HeLa) cells through constricted microchannel****, Scientific Reports, Vol. 8, pp. 17357-1 – 17357-10, (2018)*

B.Nath, A. P. Bidkar, V. Kumar, A. Dalal, M. K. Jolly, S. S. Ghosh and G. Biswas, ***Deciphering Hydrodynamic and Drug-Resistant Behaviors of Metastatic EMT Breast Cancer Cells Moving in a Constricted Microcapillary, Journal of Clinical Medicine****, Vol. 8, pp 1194-1 – 1194-15, (2019)*

KEYNOTE LECTURE V

Agal (Earthen vessel) and Pudam (Calcination) in Traditional Medicine Manufacturing: From Art to Science and Engineering

PROF. S. SENTHILVELAN
DEPARTMENT OF MECHANICAL ENGINEERING,
INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI, ASSAM, INDIA

The earthen vessel is widely used to prepare medicine in the traditional medical system (Siddha) for various technical and economic reasons. The medicine constituents to be prepared will be kept in the earthen vessel and heated at various temperatures for various periods. The reactivity of earthen vessels with medicine at elevated temperatures, thermal characteristics, and structural characteristics, including porosity, will play a significant role in the preparation of quality medicines. This presentation includes our recent efforts to identify the ideal material composition of these earthen vessels and other characteristics, including heat transfer, heat storage capability, and heat dissipation. The calcination process is being adopted to manufacture most Siddha medicines from minerals and metals; earthen vessels are kept in the pit and heated using dried cow dung cakes around the earthen vessel. The heat supplied to the medicine depends upon the amount and arrangement of cow dung, pit dimension, earthen vessel thermal characteristics, etc. This presentation includes our recent efforts to understand the characteristics of pudam and develop a simple device to replace this pudam process.

KEYNOTE LECTURE VI

Product Design and Development using Selective Reinforcement Approach

PROF. R. GNANAMOORTHY
DEPARTMENT OF MECHANICAL ENGINEERING,
INDIAN INSTITUTE OF TECHNOLOGY MADRAS, CHENNAI, INDIA

Demand for high-performance parts in modern mobility systems made the designers move towards using multi-materials in a single part to meet the multifunctional requirements of the critical parts. Modern mobility engineering, with energy from fuel cells and batteries to drive the drive motors, looks for ultra-light-weight parts to improve the miles per charge which limit wide acceptance by society. Ongoing research work in our group is focused on the development of efficient design and manufacturing processes of critical machine elements using multi-materials by understanding the functional needs. Multifunctional needs of different parts vary, and product design knowledge helps in prioritizing the functional need, and materials engineering knowledge assists in appropriate reinforcement. Case studies involving design, analysis, and experimental simulations of critical parts used in modern mobility systems will be discussed.

TABLE OF ABSTRACTS

MANUFACTURING

PART 1

M01-Characterization of Epoxy Resin Based Banana Fibre Reinforced Composite with Waste Cd Powder Filler (PaperID:117)

J.Immanuel Durai Raj[1*], K.ArunVasantha Geethan[2], A.John Rajan[3], S.Vijay Ananth[4]

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In this day and age, where everything is driven by technology, the useful lifespan of items and devices is becoming increasingly shorter, which results in an increasing amount of electronic trash. The number of compact discs (CDs) that are produced each year is in the billions, but millions of them are simply discarded. They are eventually disposed of in landfills or by open burning, both of which result in unneeded harm to our environment, as well as the waste of energy and the loss of important resources. Also, there has been a lot of interest in the area of natural fibre composites because they are easy to shape, cheap, and good for the environment. People are becoming more and more interested in natural fibre- reinforced polymer composites because of how well they work in regards to their mechanical properties, how well they resist chemicals, how cheap they are, and how light they are. Efforts have been made to reuse the waste CDs in powder form as a filler material that can be used in engineering applications. Banana fibre, epoxy, and waste CD powder were used to fabricate the composite. Mechanical properties are determined by subjecting the material to standard tests for tensile strength, flexural strength, and impact strength. Using a scanning electron microscope, the surface of the object is analysed for its morphology in addition to its mechanical properties. The experiment showed that banana fibre, when combined with waste CD powder, can function quite well as reinforcements in an epoxy matrix. Despite the lower mechanical properties values obtained when compared to pure polycarbonate, the composites can be used in applications where greater strength is not required.

Keywords: ***waste CD powder, banana fiber composite, natural fiber, CD powder filler***

M02-Evaluation of optical and structural properties of biopolymer derived carbon quantum dots (PaperID:155)

Pramila Murugesan[1], J.A.Moses[2*]

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In this work, carbon quantum dots are synthesized from gelatin by hydrothermal route. The physicochemical properties (phase structure, chemical composition, optical and structural) of as prepared carbon quantum dots were characterized using XRD, FTIR, XPS, EDAX, TEM, and zeta potential analysis. The synthesized carbon quantum dots had hydroxyl, amino, and carboxyl groups on their surface and showed strong absorption and fluorescence emission at 315 nm and 410 nm, respectively. The fluorescence intensity of carbon quantum dots is enhanced and the emission wavelength slightly shifted with increasing excitation wavelength. No significant difference was observed in the fluorescence properties at different pH (acid and alkaline) and ionic concentrations. In addition, the calculated bandgap positions of carbon quantum dots are 1.235 eV (conduction band potential) and 3.905 eV (valance band potential). The determined linear refractive index for prepared carbon quantum dots is 12.19 at 460 nm. Given their fluorescent nature, the synthesized CDs might be used as an efficient material for fluorescent-based sensing applications.

Keywords: ***Carbon dots; Gelatin; Hydrothermal; Bandgap; Multicolor emission***

M03-Assessment of intelligent CMT with TIG welding on stacked thin sheets of CRNGO electrical steel (PaperID:410)

Bhushan Y. Dharmik, Nitin Kumar Lautre*

Department of Mechanical Engineering, Visvesvaraya National Institute of Technology (VNIT), Nagpur, India 440 010

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Tungsten Inert Gas (TIG) welding remain to be a globally employed welding process used in industries till date. TIG welding is largely adapted due to its easier operations and economic perspective. The losses due to high heat input in welding possess a significant challenge for the industries to either improve or switch to some alternatives for solving the issues. One among such is associated with the stators, used in Hybrid Electric Vehicles (HEV) and electric motors (EM). Cold metal transfer (CMT) process can be a possible alternative due to its pulsed and complete robotic welding system as compared with conventional and pulsed TIG welding. The paper focuses mostly on joining the stacks of Cold rolled non-oriented (CRNGO) electrical steel composed of thin sheets (0.5 mm) largely used in stators of HEV and EM, by using CMT process. A systematic approach is adapted to highlight the investigations made after using the CMT process over a conventional TIG welding process, largely employed in joining the CRNGO electrical steel sheets. The paper also involves the mechanical (hardness variation), macroscopic (weld seam characterization) and microstructural investigations (using Scanning electron microscopy (SEM)) of the welded samples of CRNGO electrical steel, post TIG and CMT welding. The study can be used as a reference for welding on stacks of thin electrical steel sheets using CMT.

Keywords: ***CMT, TIG, CRNGO electrical steel, Microstructure, Micro hardness***

M04-Dissimilar Welding of Nickel-based Superalloy (PaperID:587)

D.Vinoth Kumar, S.Gejendhiran, A.Karpagaraj*

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Fundamental investigation of mechanical properties on different types of dissimilar welded joints is described in this paper. Dissimilar metal welding was generally employed in chemical and petrochemical plants, oil and gas industries, nuclear power plants and aerospace industries etc. For enriching the structural integrity of aerospace industries, material with high temperature resistance and high corrosion resistance is needed. For fulfilling the above criteria, Inconel 718 (IN 718) was selected due to its felicitous strengths such as high tensile, yield and creep at high temperatures with significant corrosion properties in an ominous environment. This review paper systematically highlights the effect of tensile strength and micro hardness of dissimilar metals made by various welding processes and also focuses on the significant difficulties related to the dissimilar welding of IN 718 with other metals. Gas Tungsten Arc Welding (GTAW) process comprises high micro-hardness and tensile strength properties during dissimilar welding of IN 718. Inconel 625 and SS 410 materials hold high tensile strength and micro-hardness value respectively. The influence of IN 718 filler metal has also been covered in this article because it performs an important role in decreasing some of the dissimilar welded joint problems. This paper will give better directions to the researchers to focus on future studies.

Keywords: ***Dissimilar welding, IN 718 alloy, Mechanical properties***

M05-Effect of thickness on the EMI shielding effectiveness of Cobalt ferrite Doped epoxy composites (PaperID:695)

S.Manobalan[1], Suryasarathi Bose[2], T.P.Sumangala[1*]

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[2]Department of Materials Engineering, Indian Institute of Science, C.V. Raman Avenue, Bangalore 560012, India

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The paper deals with the effect of thickness on the EMI shielding effectiveness of Cobalt ferrite/ Graphene/ Epoxy (GrEpCoF) composite samples. Samples were prepared using a simple casting method. Cobalt ferrite was synthesized using hydrothermal method. The XRD of pure epoxy, graphene and cobalt ferrite is obtained. Microstrure of pristine epoxy and GrEp sample was studied using SEM. Further GrEpCoF with varying thickness was prepared. The effect of thickness on the electric and magnetic loss and the EMI shielding is studied in the X- band (8.2 - 12.4 GHZ) and Ku band (12.4 - 18) GHz.

Keywords: ***EMI Shielding, Polymer composites, Absorption loss***

M06-Experimental investigation into laser processing of pat-silk (PaperID:925)

Evenmore Mylliem, Shrikrishna Nandkishor Joshi*

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Laser being a versatile manufacturing technology, has been employed to process various materials on the shop floor, and it has been a good alternative to various conventional manufacturing technologies because it processes materials without direct contact and can be easily controlled and automated, and its beam can be focused onto any target location with high accuracy. Being a non-contact process with no application of force, the laser has been employed to process delicate and costly materials like silk fabrics and many other fabrics. In this work, the research is carried out to explore the capability of laser technology in processing silk fabric, i.e., pat silk fabric, which is one among the three silks produced in Assam, and what problems can arise during the laser processing of pat silk fabric. Laser is known as a precise and accurate tool that is employed to process different fabrics, and because of its high accuracy, fabric wastage can be minimized. In this work, a 2.5 kW laser machine has been utilized for laser cutting of pat silk fabric of 0.4 mm thickness, and the effect of the laser process parameters on the processed parts of the pat silk fabric has been observed. Excessive burning was observed when the assist gas pressure was kept at low values and when laser power is at higher values.

Keywords: ***Pat silk fabric, Laser cutting, CO2 laser, non-contact process***

M07-Intermetallic effect on the WAAM of 2319 Al-alloy (PaperID:1371)

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In the present investigation, a GTAW-based arc source was used to deposit 10-layered 2319 Al- alloy WAAM specimens on mild steel plates to evaluate the intermetallic impact. The deposits were fabricated by 80A and 120A current whereas the other parameters were kept constant. The macrostructure shows that 80A specimens have 8.5mm height and 10.5mm width, whereas 120A specimens have 8mm height and 12mm width. 120A specimens have a higher heat input than 80A specimens, which may increase flowability of molten metal and increase in width rather than height. According to the microstructural investigation, the WAAM specimen fabricated with 80A current has little or no intermetallic effect, whereas the specimen manufactured with 120A current has a significant influence. The microstructure shows that the grains of the deposited specimens get finer from bottom to top. The bottom of the deposit has coarser grains due to more heat cycles than the top. The EDS analysis reveals the presence of α-Al and Al2Cu phases in the 80A specimen, and the 120A specimen contains α-Al, Al2Cu, and Fe-intermetallic phases. The high heat input of 120 A compared to 80A current resulting the presence of Fe-intermetallic in the 120A specimens. The average microhardness varied from 60±5HV to 80±5HV from the bottom to the top of the specimen (80A) whereas the average microhardness of the other specimen (120A) increased to 120±7HV and remains similar throughout the specimen. The presence of the Fe-intermetallic component (120A specimen) aids in improving the microhardness compared to the other specimen.

Keywords: ***Wire Arc Additive Manufacturing, 2319-Al alloy, Intermetallic, Macrostructure, Microstructure, Microhardness***

M08-Selective micro wood reinforcements for Bio-wood plastics deliberating mechanical and degradation personalities (PaperID:1383)

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Wood Plastic Composites (WPCs) have recently been making a revolution in acting as a substitute to wood based structural and furniture materials. The present world market uses non bio-degradable plastics to develop WPCs which on disposal at the end of their service life, threaten the environment by means of land and water pollution. Through this research work an alternative to such WPCs was achieved by developing Green WPCs that are more environmental friendly. Poly Lactic Acid (PLA) was utilized as the matrix material and micro sized natural wood sawdust selectively extracted from Azadirachta India (AZI), Prosopis Juliflora (PRJ) and Tamarindus Indica (TRI) trees were considered as reinforcements. Composites with 20% of wood flour reinforcement achieved through injection moulding were analysed for mechanical, morphological and degradation characteristics. PRJ reinforced composites resulted in the best mechanical strength, depicting around 10% and 24% better properties on an average than the AZI and TRI reinforced composites respectively. TRI reinforced PLA composites showed superior thermal stability and lower moisture absorption while its soil degradation was found to be more rapid than the AZI and PRJ reinforced wood plastics.

Keywords: ***Poly Lactic Acid, Wood Plastic Composites, Natural fiber composites, Bio composites***

M09-Effectuates of direct particle injection tool friction stir process for the AL/SIC surfacecoating fabrication (PaperID:1446)

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In this Project is investigated the Direct Particle Injection-Friction Stir Processing Tool (DPI-FSP) fabrication of the Al/SiC Surface Coating (SC). The Process was performed in vertical milling machine at a spindle speed of 1000 rpm with traverse feed of 20 mm/min.Peculiarity of the tool is the deletion of material preparation (Making grooves or Drill hole for filling the reinforcement particles) and continuously injected the reinforced particles during the process. The tool is fabricated the thin surface coating of Al/SiC As result, the homogeneous distribution of SiC particles on the matrix surface with particles penetrated 340 μm thick was observed the micrograph. The SC exhibited 55% of the increase in hardness as compared the base material. The X-ray diffraction results is revealed that the no intermetallic were discovered besides the SiC particles. The SC wear test results is exhibited the superior frictional coefficient of 0.71 than the Empty Pass.

Keywords: ***Direct Particle Injection Tool, Surfaces Coating, SEM, Wear***

M10-Surface grinding responses optimization with a promising eco-friendly cutting fluid (PaperID:2660)

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Lubrication and cooling are very important to safeguard grinding quality, in terms of surface integrity, surface finish, and dimensional accuracy of the workpiece, because of the friction and the heat generation associated with the surface grinding process. So, cutting fluids are used to achieve this. Due to the environmental and health impacts of mineral oil-based cutting fluids, the focus is on the use of vegetable oil-based cutting fluids. Owing to the desirable properties of cashew nut shell liquid as cutting fluid, an attempt is made to use it to optimize the surface roughness and cooling in surface grinding of EN8 material. The study deals with the analysis of the cutting parameters such as the type of cutting fluid, grinding wheel speed, grinding wheel grade, depth of cut, and workpiece speed as influential factors on the responses i. e. surface finish and grinding temperature. The performance of cashew nut shell liquid is compared with the traditional synthetic cutting fluid using Taguchi's 2^5 experimental design and L_{16} Orthogonal Array. A prediction model is proposed for both surface roughness and grinding temperature to get the optimum cutting parameters. The accuracy of the models is tested by conducting validation and confirmation experiments. The experimental results confirm well with those predicted and show that there is an improvement in the surface grinding responses.

Keywords: ***Cashew Nut Shell Liquid (CNSL), Surface Grinding, Surface Roughness/Finish (Ra), Design of Experiments (DOE), Cutting Fluid (CF)***

M11-Enhancing useful flow of cutting fluid and thermal performance in surface grinding via segmented wheel (PaperID:2775)

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Cutting temperature is reported to be a serious concern while grinding aerospace materials such as titanium alloy Ti6Al4V, which is having very low thermal conductivity. Segmented wheels designed with active abrasive region and passive non-cutting slots have been proposed as a potential solution for thermal management in grinding zone. Reduced accumulation of heat due to intermittency in cutting and enhanced dissipation through passive slots could exhibit an improved temperature control even at dry grinding conditions. As the number of segments increased, the grinding force was significantly reduced for Ti6Al4V. Under wet cutting condition, the segmented wheel could facilitate more effective flow of cutting fluid into the passive slots, which is referred as useful flow. However, there was a trade-off set by the number of segments, where an eight segmented wheel shown superior thermal performance in comparison with 32-segmented wheel. Reasoning of the same in terms of useful flow patterns and boundary layer thickness has been attempted in this paper.

Keywords: ***Grinding, Segmented Wheels, Cutting temperature, Titanium, Cutting fluid***

M12-Numerical modeling of phase prediction and geometry evolution of micro-drilling using single pulse LASER (PaperID:2865)

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Laser based micro-drilling is widely used in aerospace, medical, electronics, and automobile industries due to their high aspect ratio. While producing high-quality microdrills, short and ultrashort pulse lasers have a poor rate of material removal. The industry on the other hand is very interested in maximizing material removal to boost productivity. Long pulsed laser beams can maximize the rate of material removal, however controlling the formation of HAZ, recast layers, and circularity is a big challenge. The melt pool formation and its effects, like surface tension, recoil pressure, and viscous forces, play a crucial role in surface formation. As such, a two-dimensional (2D) axisymmetric, finite element transient numerical model has been developed to explore the temperature evolution, phase prediction, and deformation of geometry with the help of coupled heat transfer and a deformed geometry model using COMSOL Multiphysics. The prediction of the melt phase was carried out using the apparent heat capacity method. The predicted results from the developed model was validated with the published experimental results. The numerical model can be further extended to analyze the effect of laser processing parameters, pulse duration, and pulse energy on the aspect ratio.

Keywords: ***Micro drilling, millisecond-pulsed laser, Finite Element Method, Computational modeling***

M13-Exploring the effects of vibration on surface roughness during CNC face milling on aluminum 6061-T6 using sound chatter (PaperID:2954)

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Vibration is a dynamic instability of the cutting process that results from the interplay of the dynamics of the machined tool and the metal-cutting process. Vibration in the metal-cutting process causes surface irregularity, tool wear, damage, and increased cutting force. This article investigates the experimental effects of vibration on CNC face milling dependent on sound amplitude. Constant spindle speed, feed rate, and various cutting depths are the parameters considered for the simulation experiment. The machine produces chatter while cutting to various depths based on the Master Cam X9 software program during the machining process. The sound amplitude received and imported are from REW (Room EQ Wizard), results to estimate the amplitude of the acoustic resulted to a surface finish. The average roughness (Ra) and average maximum peak (Rz) testing results reveal 2.19 μm and 14.73 μm, respectively. The spectrogram shows a 21.5dB SPL (Sound Pressure Level) with a continuous oscillation from 200Hz to 20kHz at a peak time of 589.01ms, ranging from +90% to -90% sound impulse. In the end, the low sound amplitude consumes short waves and low vibration, which results in good surface polish with high frequency.

Keywords: ***CNC Machine, Surface finishing, Sound chatter, Room EQ Wizard, Vibration***

M14-Machine Learning (ML) based prediction of defects in extrusion type additively manufactured parts (PaperID:3150)

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Additive manufacturing (AM) is a disruptive digital manufacturing technology to make 3D objects, usually layer upon layer, according to computer-aided design (CAD) models. AM processes can be broadly classified into 5 categories, namely: Powder Bed Fusion (PBF), Directed Energy Deposition (DED), Material Extrusion, Materials Jetting, Stereolithography. Traditionally, process parameter development and optimization in AM processes are implemented by the design of experiment or simulation methods to additively manufacture new materials. Nevertheless, the design of the experiment approach usually involves trial-and-error, which is time-consuming and costly, particularly for metal AM. In AM processing, contemporary ML algorithms can help to optimize process parameters, and conduct examination of powder spreading and in-process defect monitoring. ML is an artificial intelligence (AI) technique that allows a machine or system to learn from data automatically and make decisions or predictions without being explicitly programmed. The three types of machine learning algorithms, namely: Supervised Learning, Unsupervised Learning, Semi-Supervised Learning. We have performed transfer learning using AlexNet to detect defects in the layer wise layer 3d printing that we have performed in the lab. Moreover, there has been an increasing concern about data security in AM as data breaches could occur with the aid of ML techniques.

Keywords: ***Additive Manufacturing, Machine Learning, Deep Learning, Neural Network, Artificial Intelligence***

M15-Impact of barriers to industry 4.0 adoption on business performance: An exploratory study of Indian manufacturing organizations (PaperID:3338)

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Research on adoption and benefits of Industry 4.0 (I 4.0) has received increased attention in recent years. Although I 4.0 has received a lot of attention from developed nations, information regarding the deployment of I 4.0 enabling technologies in the context of developing economies is scarce. Several barriers to adopting I 4.0 have been proposed in the literature so far. The current study evaluates how organizations' adoption of various I 4.0 technologies is impacted by the intrinsic and extrinsic barriers. The article also assesses how these barriers impacts the relationship between the adoption of I 4.0 enabling technologies and the business performance of manufacturing organizations from emerging economy context. The model consists of five hypotheses covering the intrinsic and extrinsic barriers, I 4.0 enabling technologies, and three constructs of business performance is developed. It is tested using data gathered from 86 Indian manufacturing companies using a partial least-square structural equation modelling approach. The results imply that barriers, both internal and external, are adversely related to the I 4.0 adoption. The analysis further reveals that adoption of I 4.0 enabling technologies improves overall business performance. The results of this study will help practitioners and policymakers understand the influence of both internal and external barriers on I 4.0 adoption and business performance of organizations.

Keywords: ***Industry 4.0, Business performance, barriers, structural equation modelling***

M16-FMEA and FTA of Coal Handling System of Power Plant (PaperID:4052)

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Maintenance of the machines along with their usefulness is a major challenge in Power Generation Plants. The effectiveness of machine maintenance is at the center of focus considering its importance in recent days which has led to the implementation of the Reliability centred Maintenance (RCM). E-maintenance, TPM, condition monitoring and prognostics programs are gaining importance in industries. This paper discusses the implementation of two essential tools of RCM i.e. Failure Mode and Effect Analysis (FMEA) and Fault Tree Analysis (FTA) applied to the coal handling system of the power plant. The power plant availability is crucial for electricity production. Hence, all the types of equipment of the power plant and its ancillaries should be maintained to avoid breakdown. The RCM -based techniques help to mitigate equipment failure by practically implementing the qualitative and quantitative approaches. This paper discusses the Failure Mode and Effect Analysis (FMEA) and Fault Tree Analysis (FTA) for the coal handling power plant in northern India. The FMEA is implemented for the ancillaries such as Side Arm changer, C-frame turn drum, and Tippler systems are discussed and the risk priority number is obtained. FTA of the critical system is discussed which gives insight into the root causes of failure. The qualitative techniques revealed the risk for various root causes and the root cause of failures so that the maintenance department could decide on a plan for the mitigation of the failure.

Keywords: ***RCM, FMEA, FTA, Coal Handling Plant***

M17-Numerical investigation of tool stirring speed in friction stir processing using smoothed-particle hydrodynamics (PaperID:4449)

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Friction Stir Process (FSP) is considered one of the most convenient, effective, and environmentally friendly manufacturing processes. Moreover, FSP was derived from the solid-state welding process called Friction Stir Welding (FSW). In these processes, a tool involves a pin that blends the material around it and a shoulder that creates frictional heat. The main part of the tool is the shoulder, where it generates a significant amount of frictional heat, which can soften the workpiece material below the melting point. On the other hand, the pin mixes the soft material to refine the grain structure. This paper aims to investigate a thermal model using Altair to numerically simulate the temperature distribution profiles of 7075 Aluminium Alloy material using FSP. Using a novel technique called Smoothed-Particle Hydrodynamics (SPH), we extracted the temperature distribution in the Stir Zone (SZ) for 900 RPM, 1200 RPM, and 1500 RPM Tool Rotational Speed (TRS) with constant Tool Traverse Speed (TTS). The temperature results obtained are incremental with increasing TRS. As a result, the temperature achieved from 900 RPM to 1500 RPM has increased by 21.20%. In addition, the obtained temperature is almost 50% of the melting point. The material flow on both Advancing Side (AS) and Retreating Side (RS) shows the thorough material mixing. The SPH technique helps to investigate the proper material flow modelling by dividing the AS and RS nodes and it was observed that they have thoroughly been mixed near the FSP tool pin.

Keywords: ***Friction Stir Processing, Numerical Model, Altair RADIOSS, 7075 Aluminium Alloy, Temperature Distribution Profile, Material Flow***

M18-Simulation of three point bending test on aluminium (Al 1100) sheets with parameters optimization (PaperID:4458)

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Aluminum 1100 (Al 1100) is light in weight and has good formability properties. Due to this, Al 1100 can be formed into the desired shape with various forming processes. Among the forming process, the three-point bending test is one of the essential processes. So, to identify its behavior under a three-point bend, this simulation work is needed. The objective of this work is to know the deformation and computational time through the simulation work. The three major input parameters of the three-point bending test, such as the thickness of the material (1.2,1.6, 2 mm), mesh size (1,3,5 mm), and deformation depth (-15, -20, -25 mm), are selected for the simulation study. Using the above process parameter L9 orthogonal array was formed. The Abacus software is used for the simulation work. Analysis of Variance (ANOVA) is prepared to find the contribution of each parameter. The regression equation is formed based on the ANOVA results for future research. Also, the results are checked with the confidence interval to identify their smoothness. With a 95% confidence interval, results are fit for deformation behavior and computational time. The mesh size is scored the first rank for deformation and computational time. The 10% error range does not cross between the simulated and predicted value.

Keywords: ***Three-point bending test, Optimization, ANOVA, Simulation***

M19-Studies on the morphology, tensile and tear attributes of Ethylene Propylene Diene Monomer rubber nano-composites reinforced with amine functionalized graphene nanoplatelets (PaperID:4532)

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Ethylene propylene Diene monomer rubber (EPDM) composites containing 0-20 phr amine functionalized graphene Nano platelets (AGNP) were fabricated by blending on a two- roll mill. The dispersion of AGNP in the EPDM matrix was evaluated by field emission scanning electron microscopy (FESEM). The prepared composites demonstrated remarkable augmentation in mechanical attributes in comparison to EPDM gum. EPDM Nano composites with 15 phr GNP demonstrated an improvement of 125%, 19%, 65.3%, 204% and 5.7% respectively in stress at rupture, elongation at failure, modulus at 100% strain and tear resistance. Such a remarkable enhancement can be ascribed to uniform distribution of AGNP in EPDM as evinced by FESEM studies. The prepared composites are intended to be used as antivibration mounts for automotive applications.

Keywords: ***Ethylene propylene Diene monomer, Graphene Nano platelets, FESEM, stress at rupture, elongation at rupture, 100% modulus***

M20-Review on friction stir welding for future potential development (PaperID:6534)

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The Friction Stir Welding (FSW) is upcoming technology, and it is solid state welding process. The FSW was first developed by The Welding Institute (TWI) in Great Britain in 1991. It gained momentum for research as well as for welding similar and dissimilar materials. FSW did not require power and pollution free process. Friction stir welding is a highly complex process comprising several highly coupled physical phenomena. The complex geometry of some kinds of joints and their three-dimensional nature makes it difficult to develop an overall system of governing equations for theoretical analysing the behaviour of the friction stir welded joints. The FSW has been found to be effective for joining hard-to-weld metals and for joining plates with different thickness or different materials. In particular, FSW can be used to join high- strength aerospace aluminium alloys and other high temperature metallic alloys that are difficult to weld by conventional fusion welding method. The principles of weld formation, welding parameters, design principles, including metal flow and thermal will affect the welding process. This paper addresses the need for future development on Friction Stir Welding for light weight and similar and dissimilar welding.

Keywords: ***FSW, Similar and dissimilar, FSW Tool, Micro-structures***

M21-Coupled electrical-thermal-structural finite element analysis of electric-assisted deformation process (PaperID:6578)

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The role of electric current in assisting the deformation process has been of much interest recently. The simultaneous application of electric current with the deformation forces is known to reduce the flow stress and improve the ductility of the material, which is desirable for forming processes. The flow of the electric current through the conductor results in heating of the specimen. Earlier, it was considered that the improved formability of the material under electric-assisted deformation was solely due to resistive heating. However, subsequent researchers have proved that the application of electric current during deformation processes affects the mechanical behavior of the materials independently. This independent interaction of flowing current with the material is termed as the 'electroplastic effect'. There exists a significant challenge to decouple the thermal contribution from the overall observed effect. The aim of this study is to present a coupled multi-field model to predict resistive heating and its effect on the deformation characteristics of the material. For this purpose, experimental result of continuous current electric-assisted compression of AA 6063 alloy has been used for modelling. A detailed finite element simulation is performed using commercially available software ABAQUS. The model predicts stress-strain behavior of the material due to the resistive heating effect, which shows a good correlation with the analytically calculated thermal behavior of the material. The electroplastic effect is obtained by subtracting the simulated results from the experimentally obtained electric assisted deformation results.

Keywords: ***Electric-assisted deformation, Formability, Resistive heating, Electro plastic effect***

M22-Wire arc additive manufacturing of commercially pure titanium bio-medical alloy (PaperID:6685)

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Metal additive manufacturing deploys metallic powder or wire as a feedstock to fabricate metallic parts by direct fusion in a layer-by-layer manner. Wire feedstock-based additive manufacturing provides certain advantages such as a higher rate of deposition, high density, and lower material wastage with less capital required. This study reports the wire arc additive manufacturing of Commercially Pure Titanium (CP Ti) and its microstructure, mechanical properties, and biocompatibility. A single-track deposition is performed to know the optimum parameters for wall structure deposition. The heat treatment is carried out to achieve desired phase transformation followed by Laser Shock Peening (LSP) as post-processing. The as-built samples showed dominant α-phase + β-phase while the content of β-phase increased after heat treatment at 900°C. the thickness of LSP affected layer is observed to be 43.4476μm along the cross-section. The hardness reduced after heat treatment and increased after LSP post processing. LSPed zone exhibited higher average hardness of ~225 HV while that of the 30min and 90 min heat treated samples is ~180 HV0.1 and ~160 HV0.1, respectively. A better antibacterial test is performed to study the inhibition zone on samples. The LSPed sample surface in the biocompatibility test. The LSPed samples showed better antibacterial effect.

Keywords: ***Wire arc additive manufacturing, biomedical alloy, Laser shock peening, Microstructure, biocompatibility***

M23-Optimization of Surface Roughness and Kerf Taper in Abrasive Waterjet Machining using Grey Relational Analysis and Response Surface Methodology of Aluminium 6061 (PaperID:7152)

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This study is focused on the study of kerf taper and surface roughness of abrasive waterjet (AWJ) cut surfaces It is the preferred method when the materials being cut are sensitive to changes in temperature. Different process parameters like water pressure, feed rate, abrasive flow rate is used as an input parameter and surface roughness is taken as output parameter. Three level of input parameters are used in this paper. Aluminum Grade - 6061 is the material used and the optimum values of the output is found by Response Surface Methodology and Grey Relational Analysis techniques. Regression equations are used for material removal rate and the results are calculated with experimental values.

Keywords: ***Kerf Tapper; Surface Roughness; MRR; Grey Relational Analysis; Response surface Methodology***

M24-Sustainable manufacturing process of ZnO nanoparticles and its biomedical activities–a review from recent literature (PaperID:7265)

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The metals and metal oxides that are synthesized at the nano-scale have found a wide range of applications in a variety of fields including textile, food, automotive, cosmetic and pharmaceuticals. These nanoparticles (NPs) possess unique properties including surface area, shape, size, optical properties, low toxicity, huge band gap and high binding energy. As a simple, affordable, and secure material for human welfare, ZnO NPs are of particular importance among the other NPs, which possess exceptional thermal and chemical as well as distinctive optical properties. The green manufacturing technique of ZnO NPs using plant/herbage extract has been documented by various researchers over the past decade. But still, there is number of prevailing issues that prevent the large-scale production of NPs and subsequent applications. This article reviews the recent (2021 and 2022) literature on the simple, efficient, affordable and environmentally friendly green methods for bio-synthesis of Zinc salts such as zinc sulphate (ZnSO4), zinc nitrate (Zn(NO3)2) and zinc acetate (Zn(CH3CO2)2) using different plant/herbage extract which is collected from various locations. Zinc salts were utilized as a precursor in this method and phytochemicals in the plant extract reduce the metal salt to lower the oxidation state and stabilize the ZnO NPs. The discussion has been done for the characterization of synthesized ZnO NPs and also the activities of the synthesized ZnO NPs including Anti-cancer, Anti-fungal, and Anti-bacteria.

Keywords: ***Nanoparticles, Green method, Bio-Synthesis, Zinc Oxide, Characterization, Medical Applications***

M25-Effect of the printing parameters on the tensile properties of thermoplastics prepared by Fused Deposition Modeling (FDM) based additive manufacturing technique (PaperID:7542)

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Additive manufacturing (AM) has significantly surpassed the prototype as well as the end engineering application. According to recent research, polymer 3D printing is becoming more accessible in the industry and medicine sector. Fused deposition modeling (FDM) is one of the most extensively utilized methods of AM for thermoplastics. In this study, an initial attempt was made to represent the mechanical properties of a 3D printed specimen as a function of layer thickness, and raster orientation using thermoplastics such as acrylonitrile butadiene styrene (ABS) and Polyamide (Nylon) using FDM with a commercially available 3D printer, the wanhao duplicator 5S. The samples were printed with raster orientation angles of 0, 90, +45/-45, and 0/90 degrees with a layer thickness of 0.1, 0.2, 0.3, and 0.4 mm. To assess the optimized parameters, tensile properties such as modulus of elasticity, ultimate tensile strength, maximum force, and maximum elongation, samples were investigated. The result shows that 90-degree raster orientation and 0.1 mm later thickness give the highest values of ultimate tensile strength. At higher layer thickness up to 0.4, +45/-45 degree shows highest ultimate tensile strength. Also, Nylon shows the highest tensile toughness compared to ABS.

Keywords: ***Additive Manufacturing, Thermoplastics, Fused Deposition Modeling***

M26-Effect of ultrasonic treatment on the synthesis of in-situ AL4043/ZRB2 nanocomposites (PaperID:8143)

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Al4043 is recognized as a good filler candidate for the welding of aluminium alloys. However, the weld strength reduction due to the presence of inherent silicon needles is one of the bottlenecks that exist in the pathway. As an alternative to address this issue, an attempt has made to fabricate Al4043/ZrB2 nanocomposite via post in-situ ultrasonic melt treatment. The presence of nanosized reinforcements can enhance the mechanical properties of filler wire and, thus the mechanical properties of the weldment. In the present study, micron composites fabricated by salt melt in-situ reaction for different weight proportions (1, 2, and 5 wt. %) of ZrB2. Further, part of the micron composite castings was re-melted and subjected to ultrasonic melt treatment (UT). Optimum UT parameters were determined using the response surface methodology (RSM) based "design of experiments" approach. The micron and nanocomposite samples prepared were perused for metallographic features and mechanical properties. For a comparison, Al 4043 monolithic alloy casting was also prepared and analysed for its microstructural features and strength. The pilot study results infer that the post-reaction ultrasonic treatment induces matrix microstructure refinement and reinforcement particle size reduction to enhance the nanocomposite mechanical properties.

Keywords: ***Al4043, ZrB2, Ultrasonic Melt Treatment (UT), in-situ nano-composites, filler wire fabrication***

M27-Influence of spot welding in adhesive bonded steel sheets on formability and springback (PaperID::8393)

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The adhesive bonded sheets are used in the aircraft and automobile manufacturing sectors especially in body-in-white (BIW) applications. Most of the parts in these applications are formed structures. From the literature, it was found that the formability of adhesive bonded sheets is influenced significantly by adhesive properties and interface bonding. Early failure of interface bonding and delamination during deformation of adhesive bonded sheets are major issues that affect the formability. In the present work, the influence of spot welding in adhesive bonded steel sheets on formability issue is investigated. During spot welding of adhesive bonded sheets, location, size and number of weldments were varied at different levels. The weld sizes were in the order of Ø3 mm, Ø5 mm and Ø7 mm. In order to vary the location of weldment, the weld was spotted at 15 mm and 30 mm from the center of gauge region. The number of weld spot was varied like 1, 2 and 3. While varying location and number of weld spots, a constant weld size of Ø7 mm was maintained. Tensile test and V-bending process were carried out. The results like failure pattern, tensile behavior, and elongation were monitored in tensile test. Springback and delamination behavior were evaluated from V-bending process. The results show that there is not much difference in varying size of the weld spots. About 6% increase in elongation is observed with two weld spots at both the extremes of gauge region of the bonded sheets as compared with a single weld at the center. It is understood that deformability of bonded sheets region between two welds increases. In the case of weld location, the weld spot offset at 15 mm shows better elongation than the weld at center and offset at 30 mm. It is understood that spotting weld at an appropriate location slightly away from the gauge region improves the elongation of bonded steel sheets. A significant reduction in springback and eliminated delamination are observed with spot welding of adhesive bonded steel sheets. This preliminary study concludes that the spot welds in the adhesive bonded steel sheets arrest the relative motion between two base materials, and influences the overall formability. The results of the present study could be useful in controlling early failure, formability, springback and delamination of adhesive bonded steel sheets.

Keywords: ***Spot welding, Adhesive, bonded sheets, Hybrid joining process, Spring back, delamination***

M28-Selection of optimal machining parameters by Taguchi-Fis simulation during machining of high tensile low alloy steel with validity check for the simulation result (PaperID:8645)

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The dry turning was done on the high tensile low alloy steel. The indoloy carbide tool was used. The input parameters were speed, feed, and depth of cut (DOC, d). The chip reduction coefficient (CRC) and von Mises stress (VMS) were the output responses. Universal tensile testing was done to find out the strength coefficient (K) and strain hardening exponent (n). "K" and "n" were incorporated to obtain the von Mises stress (VMS). The experiments were performed following the Taguchi L9 orthogonal array. The analysis of variance (ANOVA) was done for the CRC, with the lower the better condition. The ANOVA was done for VMS with the lower-better condition. The ANOVA was done by developing a MATLAB program. The feed contributed strongly to both the CRC (80.1381% contribution) and VMS (33.1490% contribution) minimizations. A Taguchi-Fuzzy inference system (FIS) simulation was done (MATLAB software) to select optimal parameters. CRC and VMS were the inputs, and MPCI (multi performance characteristic index) was the output for the simulation. The simulation was done based on the rules. The optimal parameters were found at moderate speed, high feed, and moderate DOC. Machining chips were collected for different experimental conditions. The chip form study was done. The chip surfaces were examined by scanning electron microscopy (SEM). The simulation result was validated by chip form study and SEM observation of chip.

Keywords: ***Speed, Feed, Chip reduction coefficient, von Mises stress, Taguchi-Fuzzy, Simulation***

M29-LASER powder bed fusion technique for hydrogen- fueled gas turbine: role of advanced materials and its challenges (PaperID:9028)

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Aviation accounts for 1.9% of greenhouse gas emissions, decarbonization is not straightforward as electrification is not feasible, and biofuels only partially address the issue. Therefore, aero-engine manufacturers are looking towards hydrogen as a clean fuel source as the emissions would majorly be water with no lasting greenhouse gasses. The major challenge with hydrogen-firing engines would be high firing temperatures, corrosive exhaust gasses and adverse reactions with structural components. The design flexibility of additive manufacturing (AM) and advanced materials development, such as high entropy alloys (HEAs) can be combined to produce gas turbines with higher turbine inlet temperatures and power output. This paper discusses the advantages and issues with hydrogen as fuel, the role of AM and advanced materials suitable for hydrogen-firing engines.

Keywords: ***Aeroengine, Additive manufacturing, High entropy alloys, Hydrogen fuel, Laser powder bed fusion technique***

M30-Effect of Heat Input on Weld Beam Geometry, Tensile Strength, and Microstructure of Single Pulse TIG Welded Nitinol Shape Memory Alloy (PaperID:8604)

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In this work, an attempt was made to explore the possibility of joining thin NiTinol sheet using pulsed TIG welding process. Single pulse TIG welding process was carried out on 1 mm thick sheet at four different heat inputs, viz. 17.95 J/mm, 19.28 J/mm, 19.86 J/mm, and 21.49 J/mm. The weld quality was analysed by measuring the Depth of penetration, Bead width and tensile strength. Full penetration was not achieved in any of the four welds owing to the lesser heat input. Bead width found to have reduced with increase in heat input. The metallurgical characterization of the weld is also discussed with the help of microstructures taken using Scanning Electron microscope (SEM). Tensile strength of the weld decreased with increase in heat input. At all four heat inputs, the weld tensile strength was lower than the base metal. Fractography of the tensile tested samples revealed mixed mode of fracture in all the four weld samples and base metal.

Keywords: ***NiTinol, Single Pulse TIG welding, Effect of Heat input, Bead geometry, Tensile strength***

M31- Process parameter optimisation in CO2 LASER welding of SS304-H using topsis (PaperID:6678)

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SS 304 H is one of the most widely used austenitic stainless steels in advanced ultra-super critical boilers. SS304 H has very good mechanical and corrosion properties even at elevated temperatures. Welding plays an important role in the fabrication of boiler components. Laser welding due to its ability to weld at higher speed is preferred in boiler part fabrication. In this work, an attempt is made to weld SS 304 H plates using CO2 laser welding process. Bead on plate welding was carried on 5 mm thick plates based on L27 Taguchi array. Weld quality was analysed by measuring bead geometry and hardness. TOPSIS multi objective optimization technique was applied to identify the best parameter combination that results in maximum hardness, depth of penetration and minimum bead width. Based on ANOVA, laser power was identified as the most influencing factor on the overall multi objective function. The metallurgical aspect of the optimized weld is also discussed with the help of microstructures obtained through optical microscope.

Keywords: ***SS 304 H, CO2 Laser welding, TOPSIS, ANOVA, Metallurgical Characterization***

M32- Effect of delta wire feed speed in double pulse MIG welding of IN-617 (Paper Id:6585)

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Inconel Superalloys are widely used in the fabrication of Advanced ultra-super Critical boilers (AUSC). IN 617 is one of the Inconel alloys which has very good strength, and corrosion properties even at elevated temperature. Welding plays an important role in the fabrication of boiler components. Till date, lot of works are done related to joining of IN 617 using high power density processes such as laser welding. In this work, an attempt is made to join IN 617 using double pulse MIG welding process at different delta wire feed speed. The effect of delta wire feed speed on the bead geometry and hardness was investigated. Full penetration was achieved in all the welding trails. Maximum penetration was achieved when the delta wire feed speed was at a value of 3 m/min. Bead width was minimum when the delta wire feed speed was at 2 m/min. Hardness value decreased with increase in wire feed speed. Microstructure of the weld was analysed using optical microscope and the variation of the hardness was justified with microstructure.

Keywords: ***IN 617, Double Pulse MIG welding Process, Bead Geometry, Hardness, Microstructure***

M33- Some studies on banana and sisal fibers-based hybrid composites (PaperID:8616)

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In recent years the natural fibre composite has attracted substantial importance as a potential structure material. Natural fibres attractive features often help to build the modern world's need. Natural fibre composite can be a very cost-effective material, especially for the building and construction industry. The present work has been undertaken to develop a polymer matrix composite (polyester resin) using Banana and Sisal fibres as a hybrid at various compositions used as reinforcement. The compression moulding machine fabricates fibre-reinforced composite plates. Three types of compositions are taken, the first with both Banana and Sisal fibres in 50% composition each. The second one with Banana fibres of 60% and Sisal fibre of 40% composition, respectively. The third one with Banana fibre of 40% Sisal fibre of 60% composition, respectively. The resin is taken in 40%, and fibres are taken in 60% for making the composites. The compression, impact, hardness, thermogravimetric analysis, and moisture absorption test were tested for fibre-reinforced composite plates, and the results were compared. From the results, the composite with 40% Banana fibre and 60% Sisal fibre showed high compression, impact, hardness, and heat flow rate values. Composite with 60% Banana and 40% Sisal fibres had more water absorption properties.

Keywords: ***Banana fibre, Sisal fibre, TGA, Mechanical properties***

M34- Optimization of process parameters for cutting force minimization in dry turning of Aluminum 6063 using Taguchi approach (PaperID:3662)

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This study investigated the turning of 6063 aluminium alloy for minimizing the cutting forces using Taguchi method. All 27 experiments were performed in dry condition in line with sustainable machining aspects. All responses were optimized individually. Optimal parameter was (v3-f1-d1) for minimizing all the responses. Experiment number 19 produces the optimum value of cutting force (21 N), feed force (21.22 N) and surface roughness (0.9546 μm) found through Taguchi method. The prediction mathematical model was established for all the responses for finding the optimal turning parameter. The R2 value for all the responses in the present study is almost equal to unity which shows the good prediction accuracy. The parameter depth of cut is greatly affecting the cutting force with 54.22% and feed force with 90.97% respectively. The variation in the surface roughness was mainly affected by feed rate with 73.04% contribution. From the multi-response optimization also, the optimum parameter was found as the same as that of (v3-f1-d1). The experimental and predicted results show good agreement hence; there is an enhancement in the quality characteristics of the output values.

Keywords: ***Sustainable Machining, Cutting force, Feed force, Al 6063 alloy, Optimization Taguchi approach***

M35-Effect of stick out length in Tungsten Inert Gas Welding of Hastelloy C-276 (PaperID:9322)

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In this article, an attempt was made to study the effect of stick out length on the mechanical and corrosion properties of Tungsten Inert Gas (TIG) welded Hastelloy C-276. Stick out length was varied in the steps of 2 mm with the purpose of producing three butt joints. Tensile strength, bead geometry and microhardness were evaluated for estimating the quality of the welds. The variation in weld properties was discussed with the support of Energy Dispersion Spectroscopy (EDS) and microstructure images captured from Scanning Electron Microscope (SEM). From the experimental outcomes, it was found that when stick out length was initially increased (from 3 mm to 5 mm), the hardness increased. It did not show any further significant increment when stick out length was increased to a greater value (7mm). The Tensile Strength decreased at first and then increased with increase in stick out length. Corrosion test was conducted on the best sample and it was observed that the corrosion properties of the sample were nearly same as those of base metal.

Keywords: ***Hastelloy C-276; TIG welding; microstructure; macrostructure; Mechanical properties; Corrosion Properties***

M36-Experimental Investigation and Process Parameters of Double Pulse Metal Inert Gas Welding on Inconel 718 Superalloy (PaperID:455)

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Inconel 718 is a precipitation hardened Ni-based superalloy extensively used in aerospace and energy industries due to its excellent properties. Inconel 718 alloy's strong thermal strength is mostly due to the precipitation of the prime and double prime phases, [Ni3Ti, Ni3Al] and [Ni3Nb]. It is used in the hot sections of rockets and gas turbines, including some turbine blades and the blades, discs, and casings of the high-pressure compressor, where high temperature strength, exceptional creep and stress rupture properties, and good resistance to hot corrosion and oxidation are major requirements. It has some weldability issues like micro fissuring/liquation cracking in heat affected zone, micro segregation of alloy elements like Nb which leads to the formation of topologically closed packed Laves phase in fusion zone dependent on weld heat input and cooling rate. Generally, in many applications Inconel 718 is being welded using tungsten inert gas (TIG) welding. It possesses high heat input which will leads to above weldability issues. In case of low weld heat input methods like laser welding (LW) and electron beam welding (EBW) it has rapid cooling rate that leads to hot cracking issue. The mechanical property of the alloy gets degraded due to these detrimental effects. Weld heat input as well as cooling rate should to optimized by implementing some new and emerging technique. Double pulsed (DP) gas metal arc welding (GMAW) is a special instrument for regulating the composition and characteristics of welds because the pulsation of heat input offers a flexible and efficient technique to manage temporal variation of weld pool geometry, cooling rate, and solidification parameters.

Keywords: ***Nickel based superalloys, Double pulse MIG process, Metallurgy characterization***

M37-Prediction of the bonding Mechanism of Super Alloy by Cold Spray Technology (PaperID:5441)

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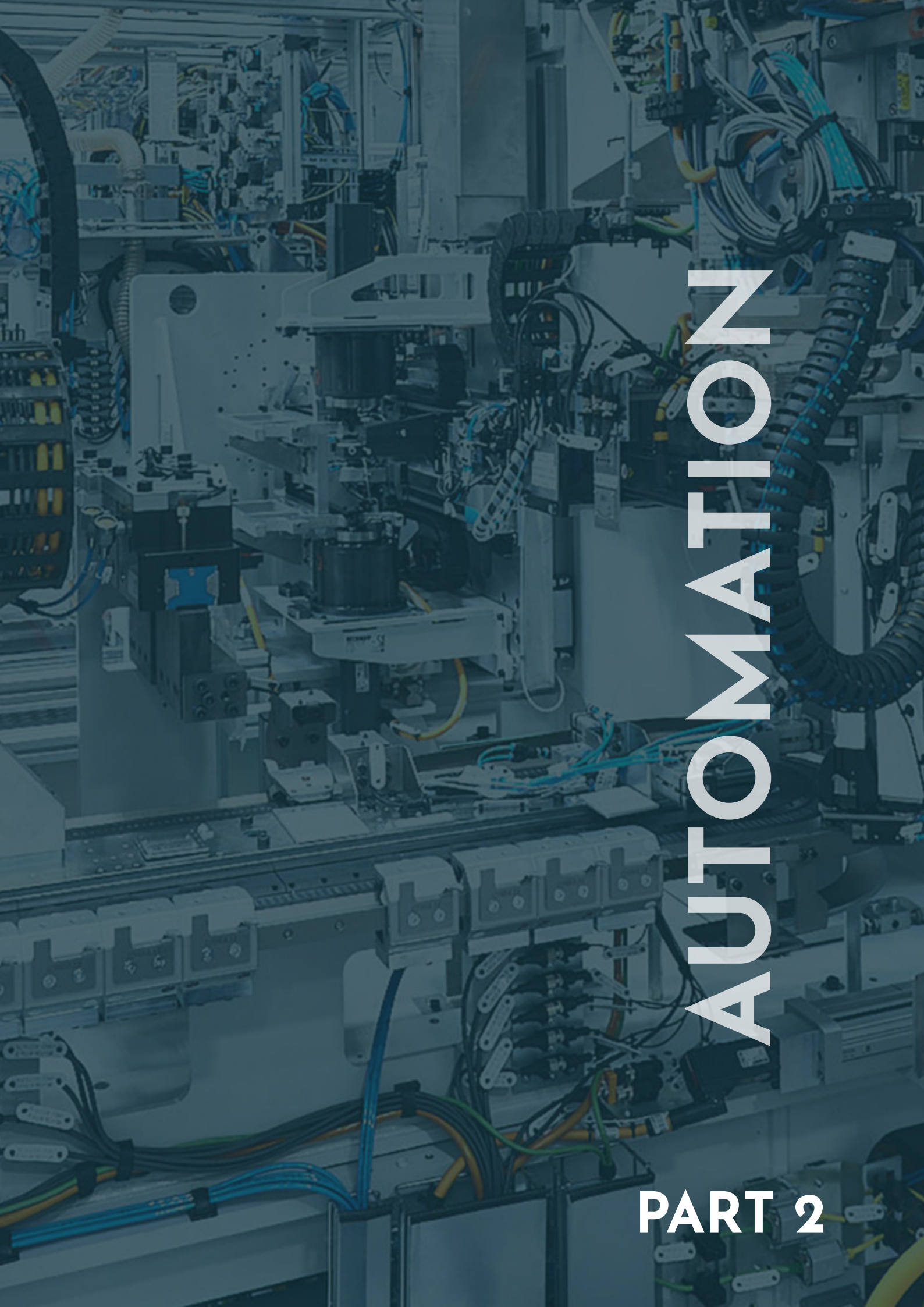
This approach suggests the prediction of critical velocity for the bonding of materials by means cold spray deposition process. The cold spraying method emerges with its unique characteristics that give high deposition efficiency with low porosity and low oxide content of hard material deposition on the substrate. However, experimental results show only the bonding states of the deposited material. The physical phenomenon that can affect adhesive bonding can be analysed using available sophisticated numerical modelling techniques. This bonding mechanism is simulated by a Finite Element Analysis (ABAQUS 6.12). In this work, a numerical modelling procedure was developed to simulate the single-particle impact during the cold spraying process. The Lagrangian Finite Element Simulation method was adopted and the results were used to predict the optimum particle velocity to ensure high-quality coating with less porosity and good strength retention. As they are accelerated to 500 m/s, the Inconel 625 particles that impact Stainless Steel's surface are predicted to be deposited on to the substrate. The occurrence of ASI at this rate of impact is verified by looking at variations in stress, strain, and temperature regarding time and difference in plastic dissipation energy and recoverable strain energy for a range of particle velocity.

Keywords: ***Cold spray, Simulation, Bonding velocity, Finite Element Method***



AUTOMATION

PART 2

A01-challenges of ISO 19650 application on public health projects (PaperID:1486)

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Despite the benefits of BIM, some challenges to implementing it have appeared due to traditional project management, especially in the construction of complex projects. This article presents the challenges to applying ISO 19650:2018 Parts 1 and 2 in public hospital projects in Peru. These challenges were identified through 28 interviews with owners, designers, contractors, suppliers, operators, and final users (doctors and nurses) and complemented by a literature review. The identified challenges were divided into the budget, legal framework, organizational culture, and personnel. The results suggest that the adversities identified in the four groups should be overcome to implement BIM according to the ISO 19650 guidelines. Therefore, recommendations are presented to facilitate the ISO 19650 implementation in public hospital projects.

Keywords: ***ISO 19650, BIM, Health Projects, Information Management, Collaborative Project Management***

A02-Time optimization proposal for the design and execution of plumbing systems implementing VDC methodology: 6-floor building case study (PaperID:1687)

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The architecture, engineering, and construction industry has been characterized in recent years by large losses of resources, time, and costs. One of the main reasons for this problem is the lack of integration and collaboration between project stakeholders in different areas and specialties. The design, coordination and installation of mechanical, plumbing, electrical (MEP), and fire protection (FP) systems represent one of the main areas of improvement in the construction industry, especially in complex projects. The present research implements the Virtual, Design and Construction (VDC) methodology as an empowering agent in the optimization of time in the design and execution processes of plumbing systems in a 6-floor building of approximately 2,120 square meters in Lima, Peru. Initially, the traditional workflow for designing and executing sanitary systems was mapped. Then, an optimized workflow was developed considering the principles of the VDC methodology. As a result of the optimized workflow, it is possible to foresee a 5% reduction in design time and a 23% reduction in execution time.

Keywords: ***Virtual Design Construction, VDC, MEP, coordination, BIM, plumbing systems, prefabrication***

A03-A review paper on mobile robot's applications in search and rescue operations (PaperID:3365)

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Mobile robots have gained popularity in recent decades, owing to its capacity to be deployed in dangerous environments without jeopardizing humans. Mobile robotic vehicles are frequently used today to carry out tasks including environmental recognition, inspecting urbanized and industrial terrains, for search and rescue activities. Presently, search and rescue robot technology is progressing from experimental and theoretical studies towards applicability. The proper execution of a mobile robotic movement in a working environment depends on being aware of the nearby obstacles and avoiding any collisions that may occur. Robots today are integrated with several smart technologies that are necessary to model the environment and localize their position, control the movements, identify obstructions, and avoid obstacles based on the terrain and surface they are employed on by applying navigational procedures. This paper explores the various mobile robotics systems and their working currently in place utilized for rescue and search operations.

Keywords: ***Mobile Robots, Search and Rescue Operations, Path planning, Control methods***

A04-Hexacopter based modern remote sensing using the YOLO algorithm (PaperID:4729)

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Remote sensing technology is essential to various industries such as agriculture, meteorology, surveillance, defence, manufacturing and processing industries. Several sectors widely adopt this technology, so much research has been conducted in this domain. In satellite applications, remote sensing research has been conducted over the past 70 years. Images and videos captured by satellites have less resolution, which undoubtedly reduces object detection and data analysis accuracy. After analysis, the imprecise nature of captured data might cause difficulties in fields such as defence and agriculture. To combat this problem, in this research, we developed a hexacopter-based modern remote sensing device that can fly with manual intervention and also has an emergency autopilot function. The proposed system is equipped with a compact high-resolution camera which captures images with a higher frame rate. The developed system uses the YOLO v4 algorithm, which is fast and accurate to recognise and track an item or a particular individual in real time. Logged data is shared with the ground station to perform the desired task. The hexacopter-based system has more mobility than the satellite-based system, which overcomes the drawback of the limited range of the proposed system. In this proposed system, we have connected a precise flight controller and a Raspberry Pi 3 Model A+ microprocessor board with other electronic components to more accurately control hexacopter flying and real-time object identification and tracking.

Keywords: ***Object Detection, Remote Sensing, YOLO Algorithm, Hexacopter***

A05-IOT based hexapod robot for surveillance (PaperID:5037)

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This paper presents an Internet of Things (IoT)-based hexapod robot designed for surveillance. The robot has a height of 50cm, a width of 40 cm and a length of 40cm. It is equipped with six legs and has a total of 18 degrees of freedom. The robot is powered by a Li-Po battery and has an Arduino Nano as its main controller. It is capable of autonomous navigation and obstacle avoidance. Furthermore, it is equipped with a vision system which provides real-time information to the robot. The robot also has a 360-Degree camera that provides additional hazard detection. The robot is capable of following pre-programmed paths and has a Wi-Fi module to monitor its status. Finally, the robot can be remotely accessed, allowing it to be used in surveillance applications.

Keywords: ***Hexapod, spider bot, A surveillance robot***

A06-Grey Wolf Optimization algorithm for tuning pi controller based speed control of switched reluctance motor for ship propulsion systems (PaperID:9169)

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Electric ship propulsion is no longer a revolutionary idea in the marine sector today. Lights were the first thing that needed electricity on board a ship, and it later applied to an electric ship propeller that is powered by an electric motor. Eventually, the idea of all-electric ships enters the picture, allowing all ship power sources to run both auxiliary and propulsion loads. Due to the great electric power constraints, numerous electric motors are used in industrial and naval ships, and the development of power electronics has made it easier to manage and regulate these motors. The switching resistance motor is becoming more popular despite its low dependability and straightforward design. Such benefits make SR motors superior to conventional adjustable speed devices. Due to their significant torque fluctuations, variable reluctance motors have recently been used in restriction traction systems. On the other side, torque ripple reduces motor performance by generating repeated noise and vibration. The suggested system controls the speed of an 8/6 pole SRM using a metaheuristic Grey Wolf Optimization Algorithm (GWO), Proportional Integral (PI) controller, and a (n+1) Semiconductor (n+1) Diode power conversion. This article's goal is to increase the proposed SRM's output cogging torque. This planner has been chosen as a promising strategy when compared to other algorithms because of its generality, decreased complexity, stability, and accuracy. MATLAB/Simulink was used to create the simulation tool.

Keywords: ***Switched Reluctance Motor, PI Controller, Grey Wolf Optimization (GWO), Hysteresis current controller, Speed Control, All Electric Ships (AES)***

A07-Construction process optimization of concrete structural elements using VDC-case study (building) (PaperID:9724)

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The construction industry is an engine of economic and social development; however, it has grown the least in terms of productivity. Furthermore, it is characterized by inefficiencies that lead to time and cost overruns. This research seeks to optimize the execution time of a multipurpose building's concrete columns, beams, and slabs by applying the Virtual Design and Construction (VDC) methodology. The VDC framework was developed to establish the client's objectives, the project's objectives, production metrics, and controllable factors. As a result, 60 possible clashes among 2 disciplines (structure & MEP) were identified before construction and solved in a collaborative environment. In addition, the execution time of the structure's concrete beams, slabs, and columns was shortened by 37% compared to the baseline from the execution of the first work lot.

Keywords: ***Virtual Design and Construction, VDC, BIM, Prefabrication, Automation***

A08-Developing an algorithm for object detection and tracking using stereo vision in LabVIEW (PaperID:4268)

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In the modern era, where artificial intelligence is gaining importance, it is imperative to keep developing efficient algorithms and low-cost models in every aspect. It has become necessary to develop a tracking algorithm that can establish a relationship between the object and the camera to determine the constantly changing distance between them. Stereovision is one of the most reliable methods to calculate the 3d depth of any object and to obtain some beneficial information for real-world applications such as surveillance cameras. This work provides a model that can detect, track and determine the distance between objects.

Keywords: ***Machine Vision, LabVIEW, Stereo Vision, Object Detection***

A09- Carbon footprint analysis integration with DFMA concept: A case study (PaperID:8164)

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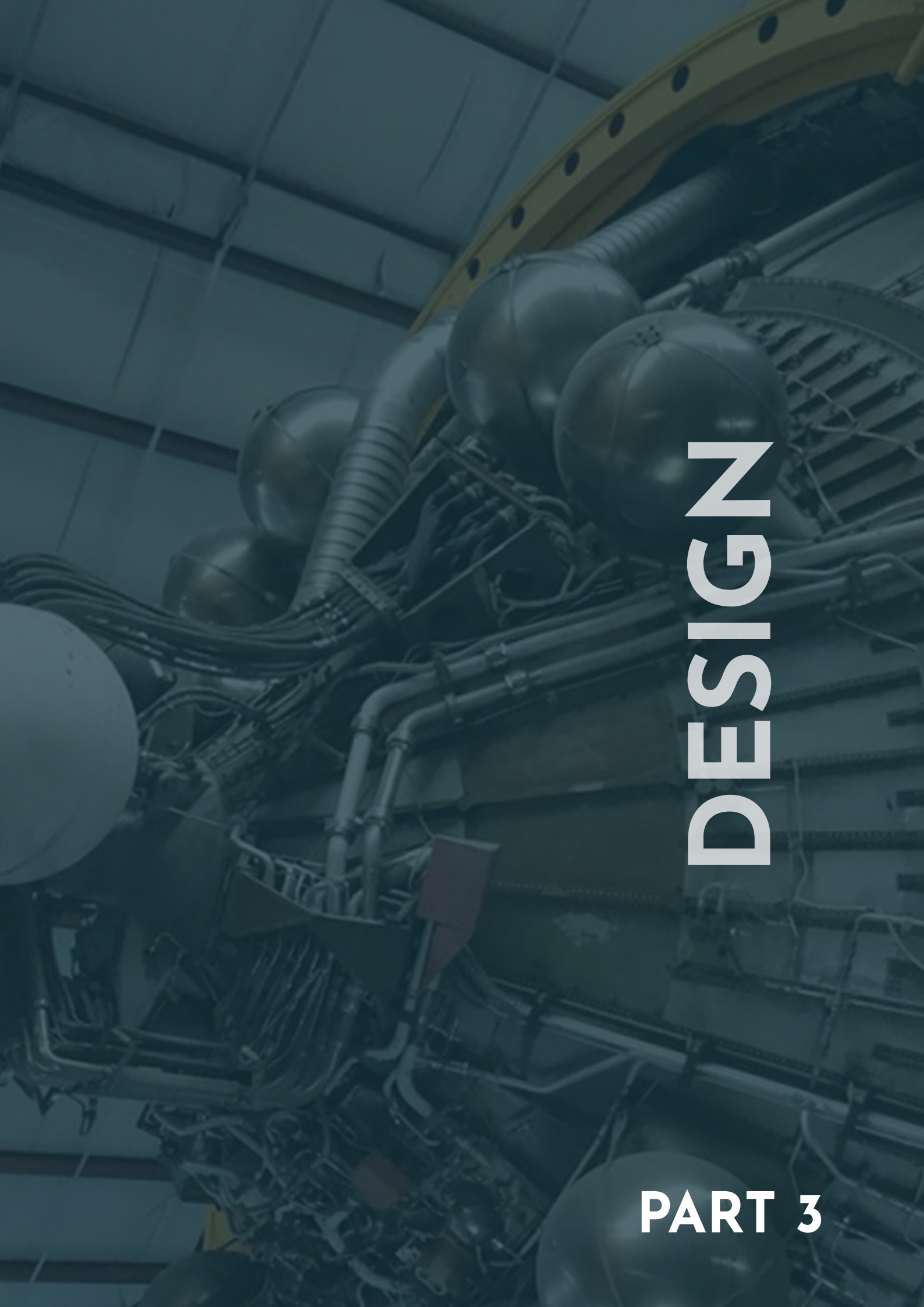
Manufacturing industries are mandated to prioritize environmental safety in recent years to meet the sustainability goals framed by the legislations. Carbon dioxide (CO2) savings rate evaluation at product design stage can estimate the environmental damage caused by the materials in their manufacture. The current research is aimed to integrate the carbon foot print assessment with the traditional design for manufacture and assembly (DFMA) concept for meeting the sustainability goals. The objective function is designed to minimize the cost, time and environmental resources consumption during the manufacture of a product. A case study has been performed by using a 6-part numbered piston assembly to validate the performed integration and compared with traditional DFMA. The results obtained by applying the proposed concept are discussed well in the article with suitable illustrations.

Keywords: ***Product design, DFMA, CO2 savings rate, assembly, manufacturability***



DESIGN

PART 3

D01-Tribological Failure Analysis of Journal Bearings used in Sugar Mill (PaperID:563)

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Sugar factory uses the sugar mills for the extraction of juice from the cane for the further processing. The size of the sugar mill will vary from the capacity of sugar factory either 2500TCD or 5000 TCD. These sugar mills are supported by using the journal bearings because of the heavy loads. After doing the survey at various sugar industry named as Sanjivani Sugar Factory, Kopargaon Sugar Factory Kolpewadi, Madha Sugar Factory etc, it is observed that they are facing the problem of frequent failure of the journal bearing liners. The present study provides the effective solution for the increasing the life of the liner with the modified polymer composites materials. The causes of bearing failure are identified by simulating the operating conditions and conducting controlled experiments on a Journal Bearing Test Rig with provisions for varied combination (i.e. load, speed, and lubricating oil) of operating conditions. The DOE technique is used to predict the performance of bearing. The theoretical and experimental results indicate the existence of boundary lubrication conditions in sugar mill journal bearings. To mitigate the problem of relatively high wear, grease lubrication with special additives should be used for the application.

Keywords: ***Roller mills, journal bearing, sugar factory, DOE, CFD, extraneous matter (EM)***

D02-Development advances in liquid rocket engines turbopump: A review (PaperID:930)

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In recent century, rocket engine development has witnessed a vast number of technological advances made in the field. Rocket engines have been a very crucial technological equipment for human race to space. With change in technology and requirement, turbopump system has been crucial for development of the rocket engine. This article provides an insight of the technology improvement over the last century and give a brief note of some of the crucial engines in humankind history. This research highlights the roadmap to understand the different categories of turbopump systems within the liquid propulsion rocket engines and lays out a comparative study of the different turbopump configurations. This article also assists researchers in understanding and evaluating their research work in the context of existing solutions. It also helps newcomers and pilots/practitioners to quickly gain an overview of the existing vast literature in the related fields.

Keywords: ***Liquid Rocket Engine, Turbopump, Rocket Engine Cycles***

D03-Aerodynamics of cricket ball swing during flight: A review (PaperID:1599)

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Cricket is the one of the most popular sport in the world with more than 2.5 billion fan-bases. The aerodynamic properties of a cricket ball are such an interesting thing that cricket players and spectators are ever curious about it for many years. While moving towards or away from the batsman, the lateral movement of cricket ball in air has been a matter of wonder since years. The phenomenon called 'swing' is sometimes surprising even to the bowlers. To understand the aerodynamic behavior, forces acting on a cricket ball are needed to be understood. Flow visualization techniques and measurements of different flow parameters are needed to introspect on this. This paper aims to report all the related studies in this field. Several experimental and numerical studies have depicted the cause of swing as geometrical non-isotropy of a cricket ball created by the stitches called seam. Seam angle at the time of projection plays a vital role in boundary-layer separation during the flight trajectory. This paper explains both conventional and reverse swing. Role of humidity, age of the ball, seam angle, surface roughness, and speed has been described with reference to the papers.

Keywords: ***Boundary-layer separation; Cricket ball; Swing bowling; Flow visualization; Fluid dynamics***

D04-Deflection study of steel-polypropylene gear pair (PaperID:1849)

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Prime mover gears typically consist of a metal-polymer pair combination. Due to their poor rigidity, polymer gears severely deflect when meshed with metal gears. The induced elastic deformation in the gear tooth causes increased gear tooth contact before and after actual engagement. Typically, the extended contact has been observed in the driving side of the metal-metal and polymer-polymer gear pairs. It coincides with the mating gear pair's addendum circle, i.e., perpendicular to the actual line of contact. But the extended contact in prime movers takes place along the coast side of the polymer gear, not coincident with the addendum circles. This article examines the extended contact phenomenon's impact on the prime mover gear pair. Polypropylene gears were meshed against the steel gear as both driving and driven companions. The behavior of the gear tooth in the extended contact zone was examined, and each contact point between the gear pair was accurately mapped. It was observed that the angle of action for Steel – Polypropylene gear pair increased to 23.2% and 11.7% in the path of recess and the path of approach, respectively. In addition, an increase in contact stress was spotted at the end of the meshing cycle.

Keywords: ***Extended contact, Plastic gears, Premature contact, Contact stress***

D05-Ungraded tire performance analysis for Indian road conditions (PaperID:2150)

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The safety of tires is an integral part of an ideal vehicle. Along with the safety, the tires' emissions are also a concern nowadays. In this article impact of various factors that directly or indirectly impact tire performance is explored and tested a set of tires to analyze factors like rolling resistance, minimum breaking energy, endurance, durability, and strength by conducting three tests specified according to the Bureau of Indian Standards and UN Global Technical Regulation. The test outcomes were used to identify the exclusions present in Indian Standards if any, and changes were recommended to align them better with the global standards. As per the tests performed, we reached to the conclusion that we can test the tires with a higher load threshold, as the value of breaking energy calculated as per IS 15633 was half the value calculated according to UN GTR.

Keywords: ***Tire Testing, Rolling Resistance Test, High- Speed Performance Test, Plunger Test, Bureau of Indian Standards, Global Technical Regulations***

D06-Finite Element Analysis based design of biomimetic functionally graded scaffolds for human cortical bone applications (PaperID:2425)

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Bone defects may hinder structural stability of a bone as an organ. Many cases require extensive surgical intervention involving the use of osteogenic cells, growth factors, and bone scaffolds for correction of bone defects. Functionally graded scaffolds ideally meet the purpose of repair of these damaged bones as they have mechanical and biological properties similar to the surrounding tissues. The properties of these biomaterial structures can be mimicked to that of the human bone for improved osseointegration and bone regeneration without causing any stress shielding effect. Triply Periodic Minimal Surface (TPMS) lattices are said to be similar to human bones, making them suitable for orthopedic implant applications. In this study, a Gyroid unit cell was designed based on implicit method using topology software. Thereafter, the Gyroid TPMS lattice was used to parametrically design a functionally graded scaffold with radial grading, mimicking the topology of human bone. Here, the scaffold porosity was varied from 62-82% from outer to inner layer, while the pore size ranged from 236-320 μm from outside to inside. The mechanical properties and compression behaviour of the scaffold were investigated by employing Abaqus the commercial Finite Element Analysis (FEA) software. Capitalizing on the cyclic symmetry, only 1/24th of the geometric model was considered for Dynamic Explicit FEA, yielding a computationally efficient solution. The obtained Young's modulus 22.1 GPa and compressive strength 205 MPa of the designed scaffold are well in the range of the cortical bone, confirming their ability to meet its structural requirements. The objective of this work is to develop a robust numerical framework to parametrically design functionally graded bone scaffolds that closely mimics the properties of human cortical bone.

Keywords: ***Cortical bone, Triply Periodic Minimal Surface (TPMS), Gyroid, Scaffolds***

D07-Emission study of catalytic converter with coating of composite nanomaterial (PaperID:2713)

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Due to increased lifestyle of human being, now a day's demand of automobile is increasing day by day. The major source of air pollutions are automobiles i.e. from internal combustion engine. Exhaust emission from these engines such as unburnt hydrocarbons, oxides of carbons, and oxides of nitrogen are more harmful for health of living beings and also environment on earth. Hence, throughout the world, efforts are taken to reduce emission level. In present study, an effort was made towards finding an alternate solution for non-noble metal in catalytic converter, also by coating it with various different nanomaterials. Catalytic converter with coating of nanomaterial shows a considerable reduction in harmful emission. Results reveal that emission of NOx, HC, CO, CO2 reduces approximately by 31%, 20%, 03% and 21% respectively.

Keywords: ***catalytic converter, copper plate, emissions, nanomaterial***

D08-Analytical approach for design of double ramp hypersonic intake for scramjet engine (PaperID:2791)

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Rockets are the non-air breathing engines used for space exploration carrying both fuel and oxidizer and increasing the cost missions. So, to reduce the cost of space exploration, research on air breathing engines known as Scramjet engines is focused. Scramjet engine achieves hypersonic speeds by the efficient design of intake. The intake provides high pressurized flow to the combustion chamber by compressing free stream flow using shock waves generated from ramp and cowl. Thus, the strength of shock waves generated in the intake due to ramps and cowl will define the efficiency of intake. The efficient design of hypersonic intake will depend on the number of ramps and angle of ramps, Osawtitsch and Kantrowitz criteria. This paper deals the design of hypersonic intake based on performance parameters like Total Pressure Recovery, Kinetic Energy efficiency and Static Pressure ratio using a python code for various Mach numbers 5, 6, 7 and 8. The proposed method designs mixed compression double ramp intake using oblique shock theory. The novelty of the present work is to understand the geometrical changes attained as per change in operating conditions of the engine. The hypersonic intake designed for Mach 5 is validated with CFD results and compared with analytical results using python code.

Keywords: ***Shock wave angle, Deflection angle, Cowl, Total Pressure Recovery, Shock on lip condition.***

D09-A Finite Element based parametric study to assess the suitability of factors used in EJMA for estimation of the meridional stresses in bellows (PaperID:2960)

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Bellows are highly engineered components. In general, the design of bellows is carried out as per standards of expansion joints manufacturer's association (EJMA). In EJMA, the basic form of the expressions for estimation of stresses are derived by considering the half convolution of the bellows as a strip beam. Since axi-symmetric shell theory leads to a more realistic response of the bellows, EJMA has introduced factors *Cp*, *Cd* and *Cf* for estimation of the meridional stress in the bellows due to pressure and deflection. These factors in EJMA are plotted as a function of two parameters viz. QW and QDT which are dependent on bellows geometry and ply thickness. This paper discusses the suitability of the above- mentioned factors considering various configurations of the bellows. A finite element based parametric study is carried out and meridional stresses in the bellows are calculated due to pressure and deflection loading for various values of the QW and QDT. Around 36 bellows of SS321 material, for which the complete details of geometry and experimental fatigue data are available in literature, are analysed numerically. Based on FE analysis, the factors *Cp*, *Cd* and *Cf* values are estimated and compared with the corresponding values given in EJMA. It is observed that for both shallow (QW approaching 1) and deeper convolutions (QW approaching 0.2), the EJMA solutions lead to an under prediction of membrane stress due to deflection loading and over-prediction of meridional bending stress due to deflection and pressure loading. The effect of geometric nonlinearities on elastically calculated stresses in bellows is quantified for various geometries.

Keywords: ***Bellows, Parametric analysis, FE analysis, EJMA***

D10-Design development and analysis of pylon prosthesis through reverse engineering (PaperID:3093)

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There have been significant advancements in artificial limbs called prosthetics. People with leg amputations may find it easier to move around with the aid of prosthetic legs or prosthesis. An artificial device known as a prosthesis or prosthetic implant replaces a missing bodily component that may have been lost due to trauma, illness, or a birth defect (congenital disorder). Prostheses are designed to replace the missing body part's lost functionality. They imitate the way a leg works and occasionally even how it looks. While some prosthetic limb users still use a cane, walker, or crutches to walk, others can do it without any assistance. To permit an amputee and to rehabilitate to a healthy locomotion its intended to develop an economical pylon prosthetics using CAD and FEA software. Nine combinations of three metal Titanium, Stainless steel and Aluminium for prosthetics specimen are developed using manual measurement and 3-D measurement. For each nine combinations the stress, strain, analysis is conducted and compared among the combinations to get an optimized model of metal combination with a maximum stress of 1.643e+07N/m2 which is near to the maximum stress of existing model 2.023e+07N/m2. This re-developed model is compared with the existing model to produce an optimized model that could meet the requirements of an amputee.

Keywords: ***Prosthetics, Amputee, Pylon, Titanium, Stainless steel, Aluminium***

D11–Lower lumbar vertebrae replacement by FEA based assessment of suitable ceramic polymer composites (PaperID:3262)

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Using bio-materials to develop a safe, secure, and prime substitute as an external entity to interact inside a human environment is a demanding area of research and expertise. The lumbar spine is the most common site for injury in the spinal column as it bears the majority of the human body's weight while also undergoing significant prolonged loading and stress. In the same direction, a cost-effective Artificial Lumbar vertebra is designed and recognized to be implanted in the spinal region of a body to replace injured or disfigured counterparts. By harnessing the power of 3D bio printing, biomaterials, and FEA, the paper proves that a simple bio-printed flexible lumbar vertebra can be integrated into the body to work in conjunction with the rest of the spinal cord just as any other of the vertebrae do, thereby working in coordination with humans. The material thus obtained will be capable of replacing the injuries in the vertebrae caused by mechanical failures like compressive loading, vertebral slip, or vertebral joint fusion. An overall lightweight structure consisting of a firm material is looked forward to for the paper's fusion. Numerous solutions in the field have asked for a higher level of safety and an adequate structure to bring about adaptability and load-bearing capacity. Moreover, a Finite Element Analysis (FEA) study corroborates the proposed biomaterial, which further ensures the successful working of our artificial lumbar joint with the spine. This insight, research, and design have led to the development of the research paper.

Keywords: ***Biomaterials, Artificial Lumbar vertebrae, Finite Element Analysis***

D12-Structural Analysis and comparison of components of oil filter (PaperID:3386)

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In order to maximize the structural density and durability of the entire oil filter, the primary goal of this research is to examine the structure and attributes of frequently used oil filter materials. For this study, we selected different materials like Polyester for the filter paper instead of using conventional paper material (glass fibre) and compared their filter properties. The model was created using Fusion 360. We also used titanium alloy for increasing the structural strength of the cover assembly. The oil filter helps to remove dirt from the car engine, it is a very important part of any car engine. We need higher chemical compatibility, high-temperature resistance, high strength, and graduated filtration techniques to increase filtration efficiency and prevent oil build-up over time. After structural analysis and CFX simulation, it was found that all selected materials have different structures and properties in a real application. In addition, the streamlined oil flow is more efficient and consistent in the polyester pleats which will increase its efficiency and durability. All the analyses mentioned above are done using ANSYS WORKBENCH Software.

Keywords: ***Durability, Filtration, ANSYS, Fusion360, and Structural Analysis***

D13-Hydrodynamic Journal Bearing: Effect of couple stress fluids on static characteristics (PaperID:4344)

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The purpose of this study is to study the effect of couple stress fluids as a lubricant on the static performance characteristics of the plain journal bearing. The analysis is done for misaligned hydrodynamic circular journal bearing with a range of couple stress parameters. The results of the misaligned journal bearing are compared with the aligned hydrodynamic journal bearing for different degrees of misalignment. The comparison of lubricant as Newtonian fluids and Non-Newtonian is also analysed. The results show that the misalignment effect cannot be ignored because of its significant influence on the film pressure, load-carrying capacity and on other static performance characteristics with better performance due to couple stress fluids as a lubricant in hydrodynamic journal bearing.

Keywords: ***Journal bearing, Non-Newtonian lubricant, Couple stress and Misalignment***

D14-Investigation and Compatibility of a Low Profile Wideband Circular Ring Patch Antenna with Slotted Partial Ground Plane (PaperID:5025)

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Lightweight, small, affordable antennas that can sustain good performance over a broad spectrum of frequencies are crucial in the current development of communication systems. The Microstrip patch antennas offer a low gain, narrowband, and efficiency. To get over narrow band's constraints, numerous designs are used. To increase the bandwidth for high data rate transmission, the suggested design has a low profile circular microstrip dual ring patch antenna with slotted partial ground plane. Analyses are done on the performance of single and twin ring patch antennas. Bluetooth, Wi-Fi, WLAN, radar, MIMO, satellite communication, and other applications of wideband are a few. The High Frequency Structure Simulator (HFSS) is used to simulate antennas.

Keywords: ***HFSS; microstrip patch; return loss; slotted partial ground plane; wideband***

D15-Experimental investigation of active suspension force control of electric motor driven actuator with estimation and tracking control strategy (PaperID:5972)

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Owing to the fastest developments of automotive electronics and control, a considerable focus is being provided on application of such techniques in automotive suspension applications. This paper presents an active force control of suspension system with Electrical actuator. To supress the variation of the sprung mass, the Mamdani fuzzy logic is used. Moreover, the unknown disturbances are compensated by active force control loop. The fuzzy logic-based disturbances compensation was performed by active force control loop (AFC). The effectiveness of Fuzzy controller and AFC loop controlled electrical actuator active suspension system was validated through numerical simulation and Rapid control prototyping experiment testing under the ISO-8608 suggested road surface. The quarter car model-electric actuator active control scheme was implemented to suppress the vibration of suspension system. The outcomes of the assessments exhibit that the recommended suspension can easily adopt its control scheme to attain a better enhancement than that obtained by conventional suspensions.

Keywords: ***Accelerometer, Suspension, Tracking control, Force control***

D16-Analysis of trench back-filling dozer blades using finite element modelling (PaperID:6006)

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The objective of this paper is to improve the dozer's sharp edges in soil refilling applications based on limited component technique. The re-enactment strategy is achieved by involving computer-aided design programming for the pressure and redirection examination. The different terminology of dozer edges is mathematically obliged with the readiness of the model and the execution is successfully achieved from the real-time experimental conditions with given boundary conditions. The energy obliged for the dozer cutting edge applications with 35 hp power inlaying machine and assessed powers acting at the soil-instrument interface. The proposed work brings about recognizing adequate resilience in changing the elements of dozer edge segments and improving the overabundance of machine weight in a strong area. Furthermore, to raise the heaviness of the sharp edge for a solid strength different material such as EN24, Grey Cast Iron, Carbon Steel, and NIMONIC 80a were considered in this research. Based on the outcomes a recommendation is suggested as a suitable material.

Keywords: ***Optimization; Design; Analysis; Dozer blades; FEM***

D17-Quasi-static failure analysis of lithium-ion battery (LIB) used in Electric Vehicle (PaperID:6750)

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Safety and reliability are two important factors for wide scale electrification of road transport sector. Lithium Ion Battery (LIB) packs are vulnerable to failure due to mechanical vibrations, impact forces and thermal runaway. Present work explores quasi - static failure mechanisms of the multi-layered structure of LIB cells subjected to mechanical loading conditions like tensile loading, three-point bending with particular on predicting the beginning of the fracture of the cell. Also, in-depth computational model for quasi-static loading is subsequently established in Abaqus, which were effective in predicting the mechanical deformation of the cell. The ultimate tensile strength for the cell casing was 400MPa and 480MPa for experimental and simulation respectively. Similarly, peak deflection of the cell was: experimental 13.8mm and numerical 13.65mm for three-point bending test. During axial compression test, Buckles were observed for 450Mpa stress and strain was around 0.0918. Mechanical behaviour of the cell casing becomes one of the important parameters for characterizing the LIB cells.

Keywords: ***LIB casing, Static analysis, Mechanical failure***

D18-Dynamic analysis of the micro-cantilever with linear width variation under electrostatic actuation (PaperID:7362)

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This paper presents the dynamic analysis of the electrostatically actuated micro-cantilever with linearly varying width. The micro-beam operates in the stable operating range. The restraining values of the voltage and the displacement (pull-in voltage and displacement) separating the stable and unstable operating region are determined by Bubnov-Galerkin approach. The effect of the change in geometrical parameters and material properties of micro-beam on the pull-in parameters is investigated.

Keywords: ***micro-cantilever, dynamic analysis, pull-in voltage, pull-in displacement, electrostatic actuation***

D19–Influence of wire properties in wire stitching of adhesive bonded steel sheets on springback (PaperID:8399)

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The adhesive bonded sheets are used widely used in aircraft and automobile body construction work. Most of the parts used in these applications are formed parts. It was observed in the literature that the formability of adhesive-bonded sheets is influenced by adhesive properties and interface bonding. Early failure of interface bonding and delamination during the deformation of adhesive bonded sheets are major issues that affect formability. The present work proposes wire stitching adhesive-bonded steel sheets with the aim of delaying failure, improving formability, and controlling delamination. During wire stitching of adhesive bonded sheets, the length of the wire, location, and a number of wire stitches were varied at different levels. The wire length was varied in the order of 10 mm, 15 mm and 20 mm. In order to vary the location of the wire stitch, the wire was stitched at 15 mm and 30 mm from the centre of gauge region. The number of wire stitches was varied like 1, 2 and 3. While varying the location and number of wire stitches, a constant wire length of 15 mm was maintained. Copper wire with diameter of 2.5 mm was used for stitching adhesive bonded sheets. Tensile test was carried out, and the results like failure pattern, tensile behaviour, and elongation were monitored. The results show that there is not much difference in elongation while varying length of the wire stitch. But smaller length of the wire stitch shows better elongation. About 2.5% increase in elongation is observed with two stitches at both the extremes of gauge region of the bonded sheets as compared with a single stitch at the centre. It is understood that deformability of bonded sheets region between two stitches increases. In the case of stitch location, the stitch offset at 15 mm shows better elongation than the weld at centre and offset at 30 mm. It is understood that stitching at an appropriate location slightly away from the gauge region improves the elongation of bonded steel sheets. However, the overall formability the wire- stitched bonded steel sheets in less adhesive-bonded steel sheets. Larger predrilled hole causes strain concentration during severe plastic deformation. This preliminary study concludes that wire stitching of adhesive-bonded steel sheets arrests the relative motion between two base materials, and reduces the overall formability. It is suggested that the wire stitching method could be useful in controlling early failure, formability, springback, and delamination of adhesive-bonded steel sheets.

Keywords: ***Adhesive bonded sheets, Wire stitching, Springback, Delamination***

D20-2D and 3D Numerical investigation on contact stress behaviour of different combinations of gear pair (PaperID:9443)

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Polymer gear gradually expanded its usage over metallic gear in power transmission applications due to its lightweight, cost-effectiveness, and higher strength-to-weight ratio. However, combinations of gear pair (STEEL-POLYMER (S-P), POLYMER-STEEL (P-S), and POLYMER-POLYMER (P-P)) were still utilized in many applications. In such applications, polymer gears are subjected to contact stress due to their non-conformal contact nature. Two-dimensional (2D) and three-dimensional (3D) Finite Element Analysis (FEA) is widely exploited to determine the behaviour of gear contact stress. A 2D FEA is widely utilized to solve due to its computational time and high efficiency. The 2D analysis is carried out under plane stress and plane strain conditions based on the gear tooth-to-face width ratio as a selection criterion. However, no investigations were performed to study the contact stress between the different combinations of gear pairs in contact. Thus, in this work, FE analysis were carried out to understand the behaviour of contact stress for different gear pair combinations under plane stress with 5mm thickness (2D) and 3D using ANSYS APDL. And also, 5 mm and 20 mm face-width PA6 gears were selected for the analysis based on the selection criteria. Normalized von-mises stress was plotted for both 2D and 3D gear pairs. Maximum stress was observed at the surface for 2D plane stress with 5 mm and 20 mm thickness conditions of all combinations of gear pairs. Whereas maximum stress was observed at 0.23 mm and 0.225 mm beneath the contact surface for 5 mm and 20 mm P-P gear pairs (driver and driven gear). In the case of P-S gear pair, 0.02 mm difference in depth between the driver and driven gear pair for a 5 mm face width gear pair. But a 0.13 mm maximum stress depth difference was observed for the 20 mm face width gear pair. Also, a similar amount of difference in maximum stress depth occurrence was observed for S-P gear pairs. A variation in stress contours was observed for 2D and 3D contact of the gear pair.

Keywords: ***Contact stress; FEA; Polymer gear; Surface stress; Subsurface stress***

D21-Conceptual study of Ornithopter for better Future Performance and Application (PaperID:9610)

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An ornithopter is a power-driven aircraft that utilizes a flapping mechanism. This paper summarized the research and development carried on Unmanned Aerial Vehicle (UAV) till date and reclaims the efficiency on ornithopter namely the flapping frequency, Reynold number, kinematics, transmission system and flapping mechanisms. The present investigation explores the design of a biologically inspired flying Unmanned Aerial Vehicle. For its execution, varied of analyses of flight mechanics, stability, and the control of flapping motion. The theoretical techniques involved in the construction of an ornithopter have investigation for surveillance, military application, spy work, and rescue operations. Additionally, the material used for construction of ornithopter is also discussed. The benefits of the flapping mechanism for are not limited. This paper also reviews the research and development done on the previous UAVs and from small birds to large birds. In this paper the experimental analysis has been done on the ANSYS Fluent on a semi elliptical wing design with a wingspan of 0.25m which delivered the output of how the wind flow and pressure can affect the efficiency of a flapping wing according to the varying angle of attack. This concluded the selection of a material with low stiffness.

Keywords: ***Flapping mechanism, UAV, MAV, Power driven aircraft***

D22-Modelling of spinal injury during aircraft seat ejection loads (PaperID:9691)

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The main aim of the present work is to calculate the ejection forces on the spine lumbar vertebra (L1-L5) using Finite element modelling. Critical time of ejection was calculated based on mathematical modelling using ejection parameters such as tail height, aircraft velocity, aircraft length. The Finite element analysis at different level of G-Forces, were performed with appropriate boundary condition to simulate seat ejection and stress on the vertebral body is analysed. The model was validated at Functional spinal unit level and multi-level model based on published literatures. It was found that, anterior side of L1 Vertebrae experiences the maximum stress, which justifies the common anterior wedge compression fracture. More stress was distributed on the superior region of endplates than that at inferior region throughout the lumbar vertebra although the difference of the stress value between superior and inferior region decreases from L1 to L5. In all the cases cortical bone experiences the maximum stress followed by endplate and the stress value obtained for Intervertebral Disc (IVD) is found to be 90% lesser than endplate, which means the initial failure may occur at vertebral body followed by endplate.

Keywords: ***Finite Element Analysis, Human Lumbar Spine, Aircraft Seat Ejection***

D23-Effect of Spike and opposing jet on different forebodies at Supersonic Speed (PaperID:9853)

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In the current study, computational research has been used to record and analyzed the shock waves produced over a variety of blunt bodies moving at Mach 2.0 with a zero-degree angle of attack. FLUENT, which uses a finite volume method to solve the compressible Navier Stokes equation, has been used for axisymmetric computations. For quick and better convergence of the computation results, the K-turbulence model has been adopted using an explicit formulation based on green-Gauss Cell-based discretization with second order upwind. The effect of forebody geometry on the flow parameters over a blunt body travelling at supersonic speed is investigated in the current study, which employs forebodies with varying degrees of bluntness (hemisphere, ellipse, and ogive).

Keywords: ***Drag reduction, counter flow drag reduction technique, Blunt body, Counterflow jet, Spike, Shock stand-off distance***

D24-Rotordynamic analysis of a complex high-speed rotor (PaperID:9945)

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High-speed turbomachinery such as cryogenic turboexpander, turbocharger, turbo-compressor, and dental drill machines are prone to rigorous vibration and instability. The rotors of such high-speed turbomachinery cannot be analysed by the fundamental Jeffcott rotor model. This is because, under the conditions of high-speed operation, the flexible rotor experiences many factors such as gyroscopic effect, shear deformation, axial torque, internal friction and viscous damping. These factors can influence catastrophic sub-synchronous whirl in the system. Turbomachinery rotors have complex geometries and involve discs, turbine, compressor and bearings. In addition, complex turbomachinery rotors operate in high-speed conditions where tangential forces come in to picture, which further influences the behaviour of a rotor and tends to destabilize the turbomachinery. The objective of the current work focuses upon the modal behaviour of a high-speed turboexpander rotor. The rotor is small-sized and incorporates a disc, a turbine, a compressor and a pair of gas foil bearings with support structures. Finite element modelling is carried out and the bearing dynamic coefficients are considered while modelling. The dynamics of the rotor is studied by estimating critical speeds, mode shapes and unbalance response.

Keywords: ***Rotor-dynamics, High-speed rotors, Gas foil bearing***

D25-Role of sintering temperatures on tribological behaviour of the compacted crab shell particles (PaperID:2711)

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The impact of sintering temperatures (100°C, 200°C, 300°C, and 400°C) on the physical, mechanical, and wear characteristics of uni-axially compacted crab shell particles (CCSP) is explored in this article. Microstructural study confirms the reduction of pores and cracks on the surface of the sintered specimen at 300°C. The XRD result revealed the presence of compressive residual stress in the sintered specimens and also evidences the absence of chitin polymer for the specimens sintered at 400°C. The specimen sintered at 300°C exhibited a higher hardness value compared to the other specimens. The pin-on-disc instrument is employed to study the dry sliding wear behaviour of the sintered specimens at ambient temperature. The surface fatigue is the major wear mechanism in all the specimens, which is more detailed in the present article.

Keywords: ***Surface Morphology, Microhardness, Friction and Wear***

D26-Application of TOPSIS for Optimization of process parameters in pulsed MIG welded Inconel 617-SS304H (PaperID:2706)

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This work attempts to identify the combination of optimized welding parameters in the Inconel 617 – SS 304H Double Pulse MIG welding process. Dissimilar weld was carried out in Butt joint configuration using AWS A5.14 ERNiCrCoMo-1 filler wire of 1.2mm diameter. Experimental trials were done based on Taguchi L9 orthogonal array with frequency, amplitude and wire feed speed as input parameters. The quality of the weld was evaluated by assessing Bead width, Depth of penetration, Hardness, Tensile strength and Impact strength. Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) Multi- objective optimisation technique was used to identify the optimized parameter combination. Frequency was identified as the most influencing factor through ANOVA. The Presence of chromium rich carbides Cr23C6 helped in strengthening the weld. With an increase of 2 HZ in frequency and 0.5 m/min in amplitude, an increase of 22% in tensile strength was observed. As well, the hardness was increased by 8%. The impact strength did not change significantly with a variation in welding frequency and amplitude. The lack of side wall fusion was observed in the weld at a lower frequency and amplitude as a result of poor heat distribution.

Keywords: ***Double Pulse MIG welding, Dissimilar Joining, TOPSIS***

D27- Estimating the velocity distribution in a viscous incompressible flow between two concentric cylinders using a tri-diagonal matrix algorithm (PaperID:5667)

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Numerical solutions to viscous incompressible flow between two concentric cylinders have been developed over the last half-century. Multi-level techniques are successfully developed and applied for the same problem where significant speed-ups are achieved. Due to the complexity of Navier-stokes equation, obtaining analytical solutions for viscous flow problems is difficult sometimes. Obtaining the exact solution of Navier-stokes equation is possible for some classical cases of steady, laminar, viscous and incompressible flows. Numerical research in this area will help researchers to develop techniques that yield accurate and faster solutions. The present work is on estimating the velocity distribution between two concentric cylinders where Newtonian fluid is used as a lubricant. The resulting partial differential equations of Navier-stokes equation after the boundary conditions are substituted are solved by the finite difference method. An algorithm named "Tri - diagonal matrix algorithm" is generated for the same. By using MATLAB, numerical analysis is performed to obtain the velocity distribution between two parallel plates. This study will serve as a basic building block for Hydrodynamic Lubrication problem. Further, the developed methodology can be used in finding the velocity profile between flat plates also. Interestingly, when working with Non-Newtonian Fluids the developed methodology will give accurate results.

Keywords: ***Viscous Flow, Concentric Cylinders, Finite Difference Method, Tridiagonal Matrix Algorithm***

D28-Study on stick-slip vibrations of Getatin Hydrogel in dry and wet conditions (PaperID:8995)

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High deformability, softness, adhesiveness and swelling ability make hydrogels highly suitable for biomedical and pharmaceutical applications like tissue regeneration, drug delivery system, wound dressing and plastic surgery. Hence understanding the adhesion and frictional characteristics of hydrogels under the dry and wet conditions is important for the development of stronger adhesive interfaces. For this purpose, direct shear sling experiments are conducted on gelatine hydrogel using low velocity linear tribometer under the dry conditions and in presence of water. Sliding experiments are conducted for 10% concentration at sliding velocities of 0.075 to 0.1mm/sec at normal stresses of 0.613-1.839 KPa. Interfacial frictional shear stresses of the sliding interfaces are measured using Slide-Hold-Slide experiments in stick-slip regime. Effect of sliding velocity, normal stress on the lubrication medium on the shear stress, stick slip behaviour, frequency of stick-slip cycles is studied in details. Presence of water at the interface reduces the shear stress substantially for all the velocity ranges. Frequencies of stick slip cycles were relatively higher in presence of water when compared to the dry. With an increase in the normal stress the frequencies of the vibration decreased.

Keywords: ***Hydrogel; Shear Sliding; Slide Hold Slide; Linear Tribometer; Stick Slip***

D29-Modelling, Analysis and application of Biomimicry of fish (Paper Id:1544)

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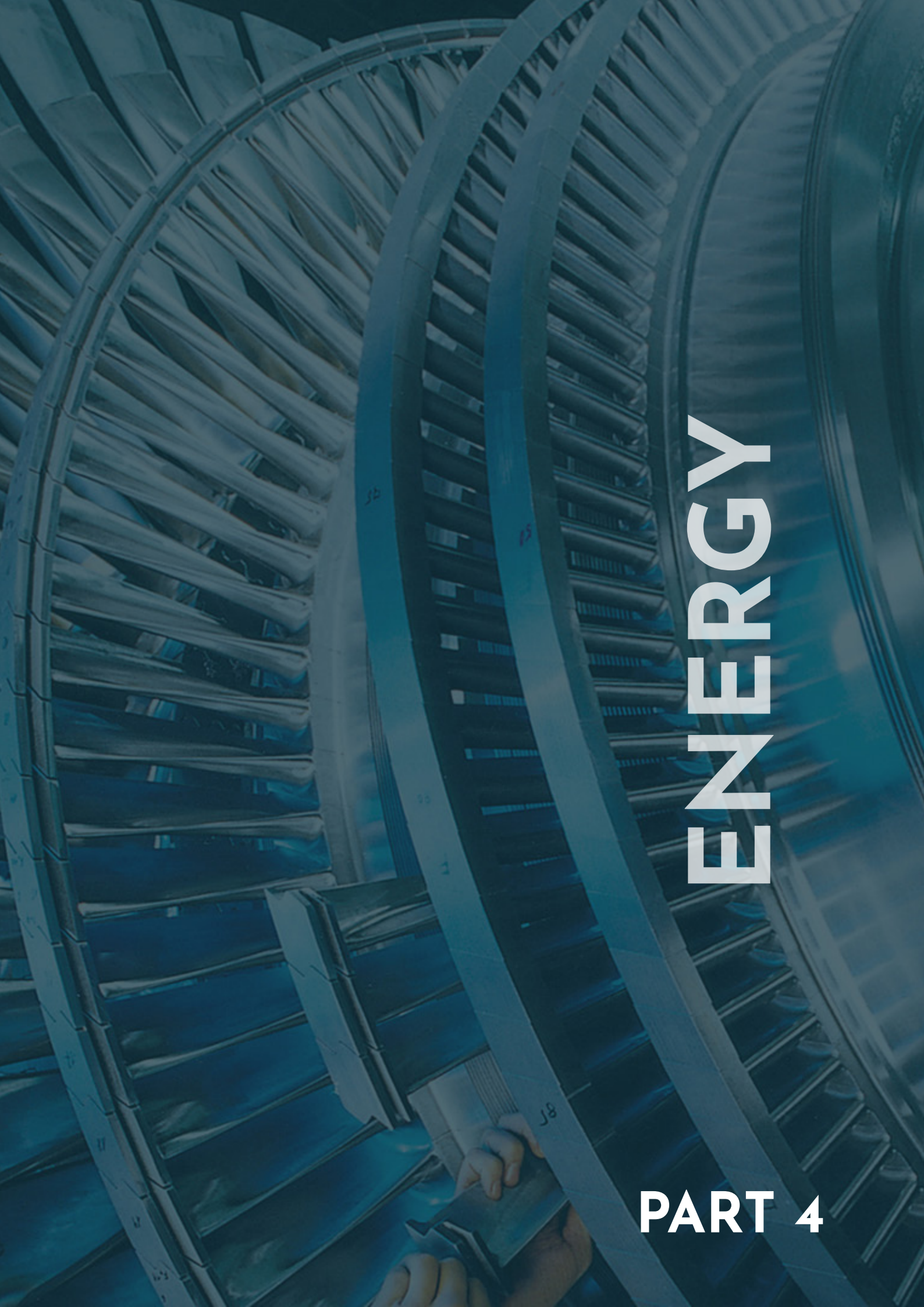
Biomimetics or biomimicry is the emulation of the systems, elements and models of nature for the in order to solve complicated problems. There are various biomimetics model which are developed for various operations like underwater explorations, water pH detection, to check the pollution level of water, etc. This report is mainly focused of designing of fish geometry for rescue operation. Based on the movement of real fishes, a tail mechanical structure for fitting carangi form fish body wave is designed. Co-ordinating the motions of the pectoral fins and tail fin, the robot fish can simulate the motion of real fishes in water. Basic understanding of components required for developing fish swim motion are studied. Finally, the CAD model of fish is presented followed with the simulation and preparation of primary prototype.

Keywords: ***Biomimicry, Carangiform, Fish Swim Motion, Rescue Operation***



ENERGY

PART 4

E01-Performance investigation of double input enhanced converter for hybrid renewable energy system (PaperID:425)

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Nowadays, power shortage turned into a massive issue in numerous countries because of increasing load demand, which cannot be solved by traditional energy power generation. These problematic circumstances motivate analysts to extract the most extreme electric power by concentrating on non-conventional energy sources. In order to extract the electric power, new extendable multi-input DC-DC converters are utilized to maximize the Power Conversion efficiency. The efficient power conversion is accomplished with minimum voltage stress across the semiconductor devices. This topology gives maximum voltage gains by expanding the quantity of input sources, thereby being appropriate for various requirements from minimum to maximum voltage/power in Hybrid Energy Systems (HES). This paper evaluates the present and the future trend of non-isolated DC-DC converters with different parameters investigated utilizing MATLAB Software. Because of the simulation result, the performances of various non-isolated converters are assessed and help to establish the appropriate converter with a specific power rating for hybrid renewable energy-based requirements.

Keywords: ***Hybrid Energy Systems (HES), Improved Positive Output Super Lift Converter (IPOSLC), Maximum Power Point Tracking (MPPT), Voltage Gain.***

E02-Role of portable charger in electric vehicle (PaperID:826)

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Emergence of rapid industrialization with recent development in technology has led to increasing trend of fossil fuel consumption that has been a major cause of global warming and climate change and has become a severe threat to global health. The global transportation sector contributing to a huge percentage of CO2 emission, thus require some sustainable and effective fuel alternatives. Electric Vehicles (EVs) serve to minimize reliance on fossil fuels in the process of driving but still depend on these fuels indirectly in the EV charging process from the conventional grid. Thus, they cannot be considered greener completely unless they are charged from Renewable Energy Sources (RES). This study presents the state-of-art overview, status of EV charging technologies and comparison between various EV charging facilities. The paper reviews the role of EV portable chargers to reduce dependence on electricity grid and help to cope with technical challenges related to EV including driving- range anxiety, long charging time and lack of charging facilities. The study focuses on the status of latest research and development in the field of EV portable chargers throughout the world and comparative analysis between four commercially available EV portable chargers is performed to introduce a scope for improvement and development of efficient, reliable, eco- friendly and user convenient EV portable chargers.

Keywords: ***Electric Vehicles (EVs), Renewable Energy Sources (RES), Battery Electric Vehicles (BEVs), Well-to-Wheel (WTW), Hybrid Renewable Energy Systems (HRES)***

E03-Design and simulation of grid connected inverters for solar photovoltaic applications (PaperID:1226)

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Solar photovoltaic (SPV) systems have become predominant in recent years and are being widely used as additional power supply to enhance power availability into the utility grid. Researchers have begun to explore more into the field of renewable energy sources (RES). Even though RES has environmental advantages, its unpredictable and intermittent nature, lack of proper technology, and low production efficiency has prevented RES to be a conventional energy source. Solar photovoltaic (SPV) systems produce electrical energy from solar energy. A solar panel converts the solar energy to DC electrical energy, after which a power inverter is used in order to convert DC power obtained from solar energy to AC power which can be fed to the grid. While feeding power from inverter to the grid, the synchronization of inverter output signal to that of the grid signal is necessary, without which failures and faults can occur in the grid which can damage electrical appliances. In the present work, simulation of a three-phase H-bridge voltage source inverter (VSI) is designed in MATLAB/Simulink platform. An LC filter is used to reduce the harmonic content of the inverter output. A synchronization technique is also developed for grid interconnection. A MULTISIM simulation model of a single-phase inverter along with an LC filter is prepared and finally a hardware model is fabricated.

Keywords: ***Solar photovoltaic, grid connected inverter, grid synchronization, Total Harmonic Distortion (THD)***

E04-Social, Environmental and Economic assessment of box-type solar cookers for domestic acceptance in India (PaperID:1682)

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To protect the environment, the United Nations Climate Change Conference was held in Glasgow with an agenda to maintain the global average temperature well below 2 °C at the preindustrial level, the substitutability of coal power plants, and inefficient conventional power plants. These goals can also be supported at the domestic level by the replacement of conventional cooking processes with box-type solar cookers. Several clean fuel technologies were adopted by different countries to mitigate the emission as mentioned in the literature but the adoption of solar cooking is lagging. This article discusses different parameters i.e., cooking time assessment, social, environmental, and economic parameters for a box-type solar cooker which can improve the adaptability in the community. In the present study, solar radiation data is collected and cooking time assessment for 4 members of the family is evaluated for the requirement of 1.5 kg rice and 0.5 kg of aloo matter sabzi. The requirement of heat is 1.4 MJ for cooking the food and this energy can be available by 2 pm when food is placed at 11: 00 am inside the cooking pot of box type solar cooker. Further, this article covers several social parameters which influence the adaptability of box-type solar cooker. In environmental analysis, the use of solar cooker indicates a reduction of 16.32 kg of CO2 monthly when used for single meal cooking in a day. The economic parameters discussion helps in the replaceability of materials used in the solar cooker to minimize the cost.

Keywords: ***CO2 emission, LPG cylinders, environmental analysis, solar cooker***

E05-Brief study on installation of floating solar power plant aimed at sustainable energy generation at ladakh (PaperID:2183)

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The need for sustainable power generation is well understood by human kind, which has encouraged several initiatives across government, private, community and individual level to move towards a clean-renewable energy based sustainable environment. Compared to Urban and Semi Urban region, rural and remote areas exhibit higher pollution from individual power generation systems like diesel generators for agriculture and other day to day activities. Particularly, electricity supply to some remote locations have always remained a challenge owing to various factors such as connectivity, transmission losses and weather conditions. Installation of local power generation systems has several advantages in providing electricity supply to these locations. Renewable energy harnessing systems using solar, wind, and geothermal energy sources may have higher chance of ease of installation and efficient operation at remote locations compared to conventional steam or thermal power plants. Leh, Ladakh is one such remote region, highly dependent on small hydro power stations and diesel generators for its energy demand. The low temperature climatic conditions, increasing tourism and recreational activities in this region demands high energy, exerting pressure on the common electricity supply chain. This article aims to conduct a preliminary study on the potential sites available for installing floating solar power plants and estimated energy generation capability at Ladakh region.

Keywords: *Floating Solar Power Plant, Renewable Energy, Clean Energy, Ladakh*

E06-Comparing solar collector efficiency with different organic fluids (PaperID:2937)

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Almost 57.9% of India's power supply comes from vapour Rankine cycle. The accelerated use of non-renewable energy has been causing hazardous problems to all. One such example being the high AQI of Delhi during October, 2022. Even water as working fluid for the Rankine cycle cause several problems that needed to be addressed:

- Water must be superheated to inhibit condensation during the expansion. This requires a lot of energy.
- There is a possibility of turbine blade rusting.
- The extreme pressure in the evaporator always poses a threat.

This leaves the door open for solutions that utilize low temperature renewable energy, to ease energy shortage and environmental problems. The world runs on fossil fuel generated electricity. This has led to a shortage of non-renewable energy, emission of greenhouse gases and global warming. There is a great need for efficient, cost-effective, clean energy production. The Inflation Reduction Act (IRA) of 2022 in the USA gives way to clean energy production solutions, like usage of low or medium-temperature energy utilization, to come up even in developing countries. This paper deals with Evacuated tube solar collectors that work on Organic Rankine Cycle. This article has done a comparative study of fluids that have been already used with two others fluids that have the potential to be used. In this paper also discuss different fluid properties and their compatibility with the ORC and how they affect its performance. Finally, applicable possibilities for various fluids are contrasted, which are favourable to ORC.

Keywords: ***Organic Rankine Cycle, Evacuated tube collector, R430A***

E07-Thermal analysis of li-ion pouch cell using phase change material cooling (PaperID:3464)

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Internal combustion engines are using conventional fuels like petrol and diesel which are the major sources of carbon emission; it affects health and causes environmental degradation. Battery-operated electric vehicles are an efficient and cost-effective solution for these issues. Lithium-ion battery technology is the best energy storage choice for Electric vehicles (EVs), but battery performance, life, safety, and cost get significantly affected by temperature. Higher temperature degrades batteries more quickly whereas lower temperature reduces power and energy capabilities. The further deviation may lead to performance degradation and thermal runaway of the battery pack which can cause fatal destruction. Therefore, to take care of this EVs are designed with Battery Thermal Management System (BTMS). Efficient BTMS prevents the deviation of cell temperature, above and below the desired temperature limit.

For thermal management of battery cells, various cooling methods like liquid cooling, air cooling, phase change material (PCM), and sometimes a combination of these can be incorporated. In this work, PCM is used as a cooling media to maintain the battery cell temperature in the desired range. NTGK MSMD empirical battery model is used to analyse the thermal behaviour of Li-ion pouch cells with PCM cooling. It is simple, takes less time, and gives good results. It is observed that with PCM (Paraffin wax) the maximum temperature difference across the cell is from 0.8°C to 1.1°C. It keeps the cell at a safe operating temperature from 28.1°C to 29.4°C. Critical areas of pouch cells are identified. Hence, it would be helpful to design and improve the battery thermal management as a whole.

Keywords: ***Electric Vehicles; Battery Thermal Management System; Phase Change Materials; Li-ion Battery.***

E08-thermal performance of a supercritical CO2 based central receiver (PaperID:3637)

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This study investigates the thermal performance of a supercritical carbon dioxide (sCO2) based central receiver for a 3rd generation concentrated solar thermal (CST) plant having 10 MW thermal capacity. A thermo-optical modelling methodology is deployed to evaluate the thermal performance of tubular receivers with outer radii of 6.2 mm, 12.4 mm, and 24 mm. The heat flux distribution on the circumference of the central receiver is obtained using solar PILOT ray tracing software. The smaller tube (r_o = 6.2 mm) receiver has maximum allowable solar flux resulting in small receiver and heliostat field for specific power output. Heat flux concentration is found to be 77 % higher in a smaller tube (r_o = 6.2 mm) receiver than in a large tube (r_o = 21 mm). However optical efficiency is 3% higher in large tube receivers compared to smaller tubes. Computational fluid dynamics (CFD) simulation is performed to investigate the receiver performance considering Inconel 640 as a receiver material. Tube having r_o = 21 mm has the highest solar to thermal efficiency (58.14%) i.e., 4.5% higher than the large tube (55.6%). Hence, further investigation is performed for the smallest tube to examine the variation of temperature, pressure drop, and Nusselt number as a function of Reynold's number along the tube. There is a marginal change (1%) in the local Nusselt number from the inlet to the outlet of a receiver tube.

Keywords: ***CST, Tubular receiver, sCO2, Heliostat field, Nusselt number***

E09-Experimental and numerical study on the performance of triple pipe heat exchanger (PaperID:4067)

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The present work is to assess the performance of triple pipe heat exchanger experimentally under steady-state conditions. Water is considered as the heat transfer fluid and is allowed to pass through the inner tube, inner annulus, and outer annulus at different temperatures. The hot water and normal tap water are considered for our experimental work. The arrangement of heat exchanger pipes is made by different materials such as Copper and galvanized iron (G.I) are used to make an inner tube, inner annulus, and outer annulus respectively. The experiments have been conducted by varying flow rate of one of the fluids at a time and keeping other two fluid flow rates constant. The exit temperature of the hot and cold fluids is measured and compared with the simulation result obtained by ANSYS Fluent software. Also, the variation of friction factor and Nusselt number with Reynolds number has been studied.

Keywords: ***Triple Pipe Heat Exchanger, Concentric tube heat exchanger, Temperature, flow rate***

E10-Design and fabrication of convergent type exhaust gas calorimeter (PaperID:4409)

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Calorimeter is a heat exchanger with the aim of improving heat transfer rate and to limit the scattering of exhaust gases. In this study reduction in amount of heat through emission is been identified and been related to existing model to get better results Comparatively. Various Calorimeter design and testing has been done using analytical software. Compared between to get better results than existing one. After modification in design the modified Calorimeter has been fabricated. It shows there is increase in heat transfer rate and increase in overall heat transfer rate than existing one. Hence concluded that after calculations and experimentation the heat transfer rate and overall heat transfer rate were efficient than the existing one and the density of hot gases is been increased by reducing the temperature of these gases which leads to limiting of gases like NOx, CO (Nitrogen oxides, Carbon Mono oxide) and etc. scattering directly into the atmosphere.

Keywords: ***Calorimeter, heat transfer rate, density reduction***

E11-Effect of diesterol blends on the noise vibration and harshness of a genset engine (PaperID:4786)

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The present investigations deal with the combined effect of Diesterol blends (B20D75E5, B20D70E10, and B20D65E15) on the performance, combustion, noise, and vibration characteristics of a compression ignition Genset engine. Studies were carried out to make the fuel blend homogeneous and stable as ethanol is immiscible in diesel/biodiesel due to its chemical structure. It is found that the Diesterol blend become stable when biodiesel is used as a bonding agent between ethanol and diesel. However, the higher concentration of ethanol has stronger bonding, which resulted in poor stability. The stable blends were used to study the performance characteristics of the genset engine. The results showed that the brake thermal efficiency increased by 10.4% by adding 5% ethanol in diesel-biodiesel compared to the 15% ethanol in diesel-biodiesel blends. The brake specific fuel consumption was found increased by 10% due to the decrease in calorific value of with the addition of ethanol. The peak value of the in-cylinder pressure gradually increases up to 10% ethanol share and further addition in the fuel blend decreases the cylinder peak pressure, which may be due to reduction in lower calorific value of the blended fuel when compared to conventional diesel. The water content in the blends reduced the combustion activity and caused slight increase in vibration due to the increased instant heat release rate in 10% and 15% ethanol share. The maximum vibration reduction was observed for the 5% ethanol blend by 1.83%. On the other hand, adding 15% ethanol decreased the engine noise by 2.7% compared to the 5% ethanol blend.

Keywords: ***Combustion, Diesterol, Genset Engine, Noise, Vibration***

E12-An experimental study on flexible PCM for compact electronic device applications (PaperID:4930)

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The advances in compact electric device are plays an important role in the digital era but the space constraints and irregular surfaces in the device makes it hard to dissipate heat with the help of external medium. The existing Phase Change Material (PCM) have the limitations as its brittleness could not occupy the irregular surfaces of compact electronic devices and undergo deformations during operation compared to new class of material Flexible PCM (FPCM). In this work, the newer thin film FPCM are prepared using Olefin Block Copolymer and parafin wax at different mass combinations and samples are studied. This paper presents selection of optimal PCM and copolymer, preparation of FPCM and detailed analysis of the sample report and electronic device applications. This report provides a basis for implementing and optimizing phase change thermal management techniques in electronic devices. thermal analysis will be studied in future.

Keywords: ***compact electronic device, thermal management, flexible phase change materials***

E13-Comparative study of performance and emission characteristics for different blended diesel fuel (PaperID:5276)

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In this present work, experimental study is performed in a single cylinder direct injection (DI) compression ignition (CI) diesel engine empowered with variable compression ratio (VCR) arrangement. Performance and emission characteristics of the engine are analysed considering ethanol and butanol blended diesel as well as pure diesel as fuel feeds. Then comparative performance and emission characteristics of the engine, at a fixed compression ratio (CR=18), is studied at different loading conditions. It is noted that, experimental results inhibit good agreement with the studies reported in the literature. It is examined that, blending of 12% v/v of butanol with diesel offers 10% more brake thermal efficiency than blending of 12% v/v of ethanol with diesel at 82% loading. NOx, CO and HC emission for 12% v/v of ethanol-diesel blend is 52%, 53% and 14% lesser than 12% v/v of butanol-diesel blend at 82% loading. Additionally, it is imparted that, although higher series alcohol addition to the diesel yields in better performance characteristics of the engine but at the same time leads to poor emission characteristics.

Keywords: ***Butanol, ethanol, compression ratio***

E14-Study on thermal performance analysis of flat plate solar air heater with heat storage coil using OM42 as Phase change material (PaperID:5581)

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The thermal performance of the solar air heating collector can be enhanced when additional heat transfer surface area and flow disturbing devices are provided. Heat storage is mandatory for solar thermal systems which minimize the reduction in thermal output due to available solar radiation fluctuation. The cost of different enhancement methods and separate heat storage systems is higher than conventional systems. Hence, the current study discusses the effect of enhancing heat transfer surface area, disturbing the airflow, and integrating short-time heat storage into the solar air collector on the thermal performance of solar air heater using the copper heat storage coil. Heat transfer enhancement is studied utilizing two distinct absorbers: spiral coiled and parallel tube absorbers with similar distances, both filled with phase change material (OM45). It stores the received solar energy in sensible and latent heat form. The stored heat is used when fluctuation occurs in the available solar radiation intensity and minimizes the heat loss from the absorber by reducing the absorber temperature. The maximum air temperature of 58°C is measured when the air flow rate is 0.0076 kg/sec. The thermal and exergy efficiency of solar air heaters is higher than conventional solar air heaters when the heat storage coil is incorporated into the system. Hence, the study may help the solar thermal research community to improve the thermal performance of the solar air heater.

Keywords: ***Solar collector, Heat transfer, Heat storage coil, Phase change material, Air heater, Spiral coil, Parallel tubes***

E15-Energy, Exergy, Economic and Environmental (4E) Analyses of Single Slope Solar Still with Phase Change Material (PCM) as Energy Storage (PaperID:7559)

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The shortage of clear and potable water is one of the most critical problems experienced all over the world. There is an urge that the existing problem be addressed immediately. Pure water resources are getting depleted day by day with an increase in pollution and population. The possible way to get rid of this problem is to transform the available sea/brackish water into fresh water through energy utilization. The conventional way of utilising energy is also a persisting problem in which the world is shifting towards sus energy sources for sustainable development. Solar energy is more efficient and abundant when compared to other renewable sources. Thus, in this context, a single slope single basin solar desalination with phase change material as energy storage is designed and developed to analyze the energy, exergy, economic and environmental performance of the single-slope still system. The 4–E analysis of the developed solar still system resulted in a 26.51% average energy efficiency, of 2.58%. of exergy efficiency, the cost per one litre is $0.0084 and the carbon credit obtained from the system is $ 183.5.

Keywords: ***Solar Still; Desalination; Energy; Exergy; Enviro economic; PCM; 4-E***

E16-Assessment of solar-biomass power potential in the state of Punjab, India (PaperID:9384)

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During COP26, India made commitments regarding generation of 50% of its electricity from non-fossil fuel resources by year 2030, which includes utilization of renewable energy sources. Keeping in view of the rapidly growing energy demand, the current study explores the exploitable solar and biomass power potential in the state of Punjab, India. This work discusses the potential and feasibility analysis of solar-biomass hybrid energy system for power generation in all districts of Punjab. Solar energy potential and biomass generation estimation have been identified using various parameters like global solar radiation, sunshine hours, solar suitable land area, surplus biomass, heating values, and feed rate. Simulations for feasibility analysis were performed on System Advisor Model using data available for all the districts. The renewable output of the study is estimated in terms of capacity potential (MW) and exploitable electricity potential (MWh) for the state of Punjab. The study showed that Rupnagar district has the maximum solar potential (i.e., 69.03 MW) among all the districts of Punjab due to huge availability of wasteland area whereas, Jalandhar district has the minimum solar potential (i.e., 0.23MW) in Punjab due to less availability of wasteland area. Similarly, Sangrur districts produces huge amount of biomass (6838.23 kt/yr) while Nawanshahr produces least amount of biomass power. In the end, the study concluded that the electricity potential for both technologies and its capability to fulfil entire electricity demand of the state.

Keywords: ***Biomass power, Solar energy, Energy potential, System Advisory Model***

E17-A novel coffee leaf pigment doped Phoenix dactylifera L biodiesel and its performance characteristics on a direct injection compression ignition engine (PaperID:5679)

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Storage stability is one of the major problems of biodiesel fuels. In this present research, biodiesel derived from Phoenix dactylifera L is doped with coffee leaf pigment in various concentrations from 500ppm to 2000ppm to improve the storage stability. All the samples doped with coffee leaf pigment showed higher stability compared to that of neat biodiesel fuel. The rancimat experimental results showed the highest induction period of 8.94 hours with the addition of 1500 ppm coffee leaf pigment in the B20 fuel blend. The engine testing proves that the addition of antioxidants improves engine performance to a considerable extent. The performance, combustion, and emission experiments were performed on the Direct Injection CI engine (DICI) by fuelling with B20 (20% DSB+80%D) doped with coffee leaf pigment antioxidant additives. Brake thermal efficiency found increased for all test fuels with respect to load due to the increased power output at higher loading conditions. However, the biodiesel with antioxidant doped blends depicted a declined trend on brake thermal efficiency at all the loading conditions. The biodiesel blend doped with anti-oxidant additives reduces the degree of oxidation of fuel molecules thereby restricting the combustion temperature which in turn reduces the brake thermal efficiency. On analysing the emission characteristics, the antioxidant addition reduces the free radical sites and curbs the oxidation reaction thereby increasing CO and HC emissions. The HC emission increased with the addition of coffee leaf pigment concentration in biodiesel due to the retarded oxidation of the hydrocarbon chain as a result of antioxidant addition. On the other hand, reduction in combustion temperature leads to a reduction of NOx emissions for all the antioxidant doped blends as oxidation of nitrogen is curbed by restricting the free radical sites and quenching the combustion temperature.

Keywords: ***Biodiesel, Coffee leaf pigment, Compression ignition engine, Phoenix dactylifera L, Storage stability***

E18- A fuzzy-based methodology for the selection of phase change material for thermal energy storage in a solar dryer system (PaperID:9301)

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Phase Change Material (PCM) has a vast application in thermal energy storage applications. The efficient thermal energy storage system design depends on the proper selection of PCM. This study found a detailed and organized process for evaluating phase change materials for Latent Heat Thermal Energy Storage design that includes pre-screening, ranking, and objectively evaluating performance using Multi-Criteria Decision-Making tools. Among the PCMs available for low-temperature heat storage applications, organic PCMs are an attractive option over inorganic PCMs. The following properties, like thermal conductivity, specific heat capacity, melting point temperature, latent heat, cost, and ease of availability, are considered in PCM selection. This work aims to select an eco-friendly, economical, and thermal-efficient PCM for low-temperature (40–80 °C) solar dryer application from the thirteen identified PCM. VIKOR's technique is used to select the suitable PCM from the identified PCMs like Natural Soya Wax, Bee Wax, Paraffin Wax, Palm Wax, Stearic Acid, Lauric Acid, Palmitic Acid, Medicine Paraffin Wax, RT55, RT60, P116, Shellac Wax, and Cr+55a. This technique ranks the identified PCM using the appropriate properties. Paraffin wax ranks at the top satisfying all the required properties for this proposed work. The results showed that this technique is feasible for selecting the best-suited phase change material and can be applied to any selection decision-making problem to find the best materials.

Keywords: ***Thermal Energy Storage, Phase Changing Material, Thermal Conductivity, Solar dryer***

E19- Experimental Investigation on pH and Stability of Distilled Water-Ethylene Glycol Mixture with Graphene Nanoplatelets (PaperID:4270)

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An efficient heat transfer medium improves the overall efficiency of the equipment, and the main difficulty is with making well-dispersed nanoparticles in base fluids. The current research is focused to study the effect of different surfactants on nanoparticle dispersion and enhancement through property modifications. The stability and pH value of various surfactants with varying sonication durations are studied compared with the graphene nanofluids. The graphene nanofluids were prepared by two-step method that involved dispersing graphene nanoparticles of 0.1wt% in distilled water and ethylene glycol (70:30). The surfactants Cetyltrimethylammonium bromide (CTAB), Polyvinylpyrrolidone (PVP K-30), and Polysorbate 60 (Tween 60) each 0.1wt% were used for stabilizing the nanofluids. The duration of sonication process is set as 60, 90, and 120 minutes respectively followed by the magnetic stirring time of 60 min. The stability behaviour of nanofluids were studied and through visual inspection, UV spectrum and zeta potential techniques and the corresponding pH values were measured to correlate the performance of the heat transfer equipment. The results show that the dispersion of graphene nanofluids depends strongly on the type and amount of dispersant in the absolute value of zeta potential. Finally, the optimum conditions were found based on the enhanced stability, pH, and sonication time of graphene nanoplatelets in distilled water-ethylene glycol mixture with Polyvinylpyrrolidone (PVP K-30) as surfactant for the battery thermal management systems in electric vehicles.

Keywords: ***BTMS, Graphene nanoplatelets, Nanofluids, pH value, Stability Surfactant***

E20- Compression behaviour of bio-inspired lattice structures inspired by Papilio Xuthus (Paper Id: 7310)

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The main objective of this research is to study the compression behaviour of a Novel bio-inspired lattice structure from the wing structure of one of the butterfly species named Papilio Xuthus. Two major parameters are chosen from the structure to make multiple designs that may cause changes in the behaviour of the structure among all available parameters. The parametric values required for the designs were calculated with the help of Response Surface Methodology (RSM) using Minitab software. The proposed designs are modelled in Autodesk fusion 360 modelling software and 3D printed specimens of size 40x40x40 (all in mm) fabricated by the Vat polymerization principle based on the chosen parameters. Then, the 3D-printed specimens were tested for compression test using universal testing machine equipment. The test results obtained from the testing process were evaluated and a lattice structure with better performance was compared with the honeycomb structure.

Keywords: ***Bio-inspired lattice structure, Response Surface Methodology (RSM), Papilio Xuthus, Vat polymerization, compression test, honeycomb structure***

E21- Characterization of process parameters in micro EDM on stainless steel (PaperID:5138)

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Micro-Electrical Discharge Machining (Micro-EDM) is one of the derivative forms of EDM. This is a versatile operation to create micro-holes on hard materials for conduction used in micro machining applications. Short duration pulses of electric discharge and a high density of current between the tool and the work piece removes material on the surface. The dielectric fluid flushes away the metal that has deteriorated on the work piece's and tool's surfaces. Because of its increasing uses in many sectors, a study had been conducted to assess the influence of Micro-EDM process parameters on Stainless Steel 304 employing brass electrode. The current research focuses on the effects of factors such as Pulse on Time (Ton), Pulse off Time (Toff), and Peak current on output parameters such as Metal Removal Rate (MRR) and Tool Wear Rate (TWR). Drilling micro holes with sizes of 1.0 mm and 1.5 mm on SS 304 is done for this purpose. To examine the results, the Taguchi method is used. The results are then graphically assessed in order to study the performance measures of Micro-EDM.

Keywords: ***Micro EDM, Process Parameters, MRR, TWR, Taguchi***

E22-Design and simulation of combined flue gas and steam bagasse dryer to increase boiler efficiency of sugar factory (PaperID:984)

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Bagasse is a sugar industry residue that can be utilized to generate electricity. Bagasse moisture content is a severe problem that reduces calorific value and boiler performance. In the Arjo Diddesa sugar mill, bagasse has a moisture level of 52%, which influences boiler efficiency. To minimize the moisture content in bagasse, the Steam Heated Rotary Dryer (SHRD) technology was adopted. The Arjo Diddesa sugar plant uses traditional SHRD technology, which uses waste flue gas to decrease moisture content. Steam passes through the inner tube to reduce heat losses, while bagasse and flue gas pass through the outer spinning cylinder, resulting in indirect steam-bagasse and direct flue gas-bagasse contact. Pressure, temperature, and mass flow rate of hot steam, flue gas, and bagasse were input parameters for the SHRD, which was developed and optimized using ANSYS software. The SHRD system is tilted to the horizontal at an angle of 4o and rotates at a speed of 4.6 rpm to aid in transporting wet bagasse. The end result shows a reduction in bagasse moisture content from 52% to 45% and an improvement in boiler efficiency from 3.5% to 71.5%-74.5%. The comparison was made, and the results reveal that the calorific value was increased by an average of 1500 kJ/kg.

Keywords: ***Bagasse Dryer, Design and Simulation, Boiler Efficiency, Calorific value, Flue Gas***

E23-Integration of BCS and AC unit in EV (PaperID:8245)

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As concerns about oil depletion and security of supply remain as serious as ever, and in the face of the consequences of climate change due to greenhouse gas emissions, battery electric vehicles (BEVs) are seen as a promising technology that could lead to decarbonization. Fleet of light commercial vehicles and independence from oil. However, some indispensable factors limit its applicability, such as the weakening of performance under extreme driving conditions due to the generation of heat in the battery. Batteries also work on the voltage difference principle, and at high temperatures the electrons inside are excited, reducing the voltage difference between the two sides of the battery. Since batteries are only made to work between certain temperature extremes, they will stop working if there is no cooling system to keep them in their working range. Therefore, it is necessary to investigate the effects of heat generation on the various components of the battery and make the best course of action for them. Therefore, understanding the effect of temperature and accurately measuring the temperature inside the batteries is important for proper battery management.

Keywords: ***Li-ion battery, battery module, electric vehicle, fins, AC unit, BMS***

E24-Experimental study on electric–rickshaw (PaperID:9637)

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According to the Indian government's strategy on electric vehicles, more and more manufacturers are now manufacturing Electric-rickshaws (E-rickshaw) for short-distance commuters. However, the producers either employ Lithium- ion (Li-ion) battery packs or lead-acid batteries, which were most recently used. Li-ion batteries have some drawbacks, such as memory issues and limited life spans. This project involves designing and fabricating a new, lighter-weight E-rickshaw chassis with a combie braking system for the rear wheel brake. Use a lithium ferro phosphate (LiFePO4) battery pack with an integrated battery management system (BMS) in place of the commonly used Li-ion battery pack to enhance the battery pack's lifespan. The E-mileage rickshaws are also improved by having a lighter frame.

Keywords: ***Electric-rickshaw (E- rickshaw), BLDC motor, Controller, LiFePO4 Battery, DC-DC Converter***

THANK YOU ALL !!

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